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BERGOLD (G.) & RIPPER (W.). *Perilampus tristis* Mayr als Hyperparasit des Kieferntriebwicklers (*Rhyacionia buoliana* Schiff). [*P. tristis* as a Hyperparasite of the Pine Shoot Tortricid, *R. buoliana*.]—Z. Parasitenk. 9 no. 3 pp. 394–417, 19 figs., 30 refs. Berlin, April 1937.

The pine shoot moth, *Rhyacionia buoliana*, Schiff., has a large number of parasites in Europe which, however, fail to check it effectively, one reason being their destruction by *Perilampus tristis*, Mayr. This hyperparasite was studied in 1931–35 in the field stations established in Austria by the U.S. parasite laboratory [R.A.E., A 23 170], the host material of *R. buoliana* being obtained from about 68,000 shoots of Scots pine (*Pinus sylvestris*).

A table is given showing various aspects of the interrelationship of the tree, all stages of the pest, and the parasite complex.

Larvae of *R. buoliana* were noticed not only in young stands, but also in stands of tall pines 40–60 years old. Disinfested young stands can therefore be re-infested from old ones and, in these, parasites are at present the only available means of control.

The parasites in Austria may be divided into two groups: those that do not prevent the parasitised larvae from continuing to cause injury and those that kill the larvae before injury to the May shoots occurs [A 24 754]. Of the more important species, the Ichneumonids, *Cremastus interruptor*, Grav., *Pimpla (Exeristes) robator*, F., *P. examinator*, F., *P. ruficollis*, Grav.; the Braconid, *Orgilus obscurator*, Nees; the Chalcidoids, *Tetrastichus turionum*, Htg., and *Perilampus tristis*; and the Tachinids, *Lypha dubia*, Fall., and *Actia nudibasis*, Stein, belong to the first group. The Chalcidoids, *Trichogramma evanescens*, Westw., *Habrocytus* sp., *Eupelmus urozonus*, Dalm., and *Copidosoma geniculatum*, Dalm., belong to the second. The Ichneumonids, *Omorgus mutabilis*, Hlmgr., and *Campoplex* sp., are sometimes in the first group and sometimes in the second. The first three Chalcidoids of the second group are insufficiently specialised for introduction into North America.

Some species from each group are so heavily parasitised by *Perilampus tristis* as to be only of slight value against *R. buoliana* in Austria. *P. tristis* parasitises *O. mutabilis*, *Campoplex* sp., *C. interruptor*, *O. obscurator*, *P. ruficollis*, *L. dubia* and *A. nudibasis*.

P. tristis, which occurs in Europe and North America, has been recorded from *Cydia pomonella*, L., and *Olethreutes gentiana*, Hb., and appears to be markedly polyphagous. All stages are briefly described. When bred from parasites of *R. buoliana*, adults were obtained on 21st June from *Omorgus mutabilis* and up to the end of August from *Pimpla examinator*.

Details are given of the manner in which the first instar larva of *P. tristis* lives in autumn and winter inactive beside the larvae of the primary parasites in the same host and parasitises them in spring. If none occurs, it parasitises the parasites of the pupa, or in the absence of these also, it is found in the adult moth. If it enters a primary parasite larva, it remains in it until the latter pupates, then issuing to become an ectoparasite of the parasite pupa. After an ectoparasitic life of 5–11 days, it enters its second instar, the first having lasted 9–11 months. The second, third and fourth instars are ectoparasitic. In one instance these lasted 4, 4 and 9 days respectively, and the pupal stage required 8–15 days. Parasitism of *Omorgus mutabilis* by *P.*

tristis was 43.5–86.5 per cent. The percentages were 30–85 for *Orgilus obscurator*, 0–81 for *Cremastus interruptor*, 10–35 for Tachinids and 10–17 for the pupal parasite, *Pimpla examinator*.

P. tristis overcomes solitary parasites (such as *O. mutabilis*, *O. obscurator*, *L. dubia*, *A. nudibasis*) and hyperparasites such as *P. ruficollis*, but it is overcome by polyembryonal and mass parasites (*Copidosoma geniculatum*, *Tetrastichus turionum*). These two species have therefore been selected for introduction into U.S.A. [A 23 170], and in 1936 they were also sent to England and Canada.

O'KANE (W. C.) & GLOVER (L. C.). **Further Determinations of the Penetration of Arsenic into Insects. Studies of Contact Insecticides.** XI.—*Tech. Bull. N.H. agric. Exp. Sta.* no. 65, 8 pp., 5 figs., 2 refs. Durham, N.H., June 1936. [Recd. June 1937.]

In further studies of the penetration through the integument of arsenic from arsenious oxide or sodium arsenite confined in beeswax cells on the dorsal surface of the metathorax of *Periplaneta americana*, L. [cf. R.A.E., A 24 81], less arsenic (measured as arsenious oxide) was recovered from cockroaches reared under constant conditions than from those trapped in a cotton mill, but statistical analysis showed the difference to have no significance. The amounts of arsenic recovered from the bodies of cockroaches treated with anhydrous arsenious oxide for 72, 120 and 168 hours were 0.010, 0.025 and 0.021 mg. per gm. body weight respectively, and from those treated with sodium arsenite for the same times were 0.073, 0.103, and 0.162 mg. per gm. body weight, respectively. The fact that in the case of arsenious oxide, less was recovered after 168 hours than after 120, shows that after a certain period arsenious oxide was eliminated as fast as it was taken into the body. With sodium arsenite, liquid appeared in the cell, the amount increasing with time so that in 7 days practically all the powder was dissolved. In the cell containing arsenious oxide, the powder became damp but there was no excess liquid present. As, in addition, sodium arsenite penetrated the integument 7 times as fast as arsenious oxide, it appears to be more soluble in the liquid present on the integument. When the area to which the arsenical was applied was doubled, about 3 times as much arsenic was recovered, but when the amount of powder applied was tripled without increasing the area of application, the amount recovered after 72 hours was not significantly greater. The excess powder did not become damp or dissolve. When high concentrations of arsenic were built up in the body of the cockroach, arsenic was recovered from all parts and tissues, although those nearest the point of application generally contained most.

OVERLEY (F. L.), OVERHOLSER (E. L.) & ST. JOHN (J. L.). **The present Status of Spray Residue Removal.**—*Bett. Fruit* 31 no. 12 pp. 2–5. Portland, Ore., July 1937.

The following is from the authors' summary : The residue removal experiments with somewhat varied spray programmes lead to the following observations :—

The use of sprays that build a heavy coverage (150 micrograms or more As_2O_3 per sq. in.) late in the season for the second brood codling moth results in difficult residue removal and only the more effective

washing programmes can be expected to clean the apples satisfactorily. This is true when mineral oil is used in the second brood with nearly any combination of materials including the lead arsenate Dynamite combination sprays. Nevertheless, such late sprayed and heavily sprayed fruits can be cleaned with the better washing machines, employing revolving, underneath, cross, short-bristle brushes, full overhead flood, tandem tanks, very thorough rinse, and with highest permissible temperatures and concentrations. It should be kept in mind, however, that drastic washing procedures may impair the keeping quality of the fruit by acceleration of water loss and consequent wilting, by rotting or by unattractive appearance. Seasonal conditions apparently have a bearing on the extent of such injury.

The calcium arsenate sprays, from the point of view of cleaning, offer much promise, since they contain no lead, and, furthermore, the arsenic in the residue is more readily removed.

These experiments have shown no relation between the rate of dehydration of the fruit and the quantity of residue remaining on the fruit after washing. As a general rule, however, the more rigorous the washing procedure, the better the cleaning, and at the same time the greater the impairment of the quality of the fruit.

FERRIS (G. F.). *Atlas of the Scale Insects of North America.*—Demy 4vo, 9 + [272] pp., planographed, [106] pls. (Nos. S.I. 1-S.I. 136). Stanford Univ. Pr., Calif.; London, H. Milford, 1937. Price 40s. (\$8·75.)

In this book an attempt is being made to gather together all the species of scale insects known from N. America, with the primary aim of making possible their identification. All species and almost all genera are illustrated, one full page plate being devoted to each (which may be purchased separately if desired), with short notes on the scope and synonymy on the opposite page. This first series deals with the tribe DIASPIDINI, subfamily DIASPIDINAE. In all, 34 genera are dealt with, including 7 new ones, and 100 species, including 10 new. It is estimated that the work may be completed in about 10 years and that it will include as many as 750 species.

GRISWOLD (G. H.). *Common Insects of the Flower Garden.*—Ext. Bull. Cornell agric. Exp. Sta. no. 371, 59 pp., 40 figs. Ithaca, N.Y., March 1937.

Control measures are given for insects and other pests, which are briefly described, of common flowering plants in New York State. A final section deals with the preparation and application of quantities of insecticides suitable for use in small gardens.

WONG (Chi-yu) & CHING (Meng-hsiao). *Biological Investigations on the Cabbage Butterfly (*Pieris rapae* L.) in Hangchow.* [In Chinese.]—Yearb. Bur. Ent. Hangchow 5 (1935) pp. 1-15, 18 refs. Hangchow, October 1936. (With a Summary in English.) [Recd. June 1937.]

In the neighbourhood of Hangchow, *Pieris rapae*, L., causes an average loss of 18·6 per cent. of cruciferous plants. Females under observation deposited 8-527 eggs singly on the underside of the leaves.

The larvae hatched in 2·8-10·5 days, and the average larval periods of the eight generations occurring yearly in the insectary were 18·20, 13·08, 13·18, 12·06, 13·04, 13·94, 15·86, and 18·64 days, respectively. About five generations occur in the field. Natural enemies of this pest include sparrows, *Pteromalus puparum*, L., *Brachymeria obscurata*, Wlk. [cf. R.A.E., A 25 197] and *Apanteles glomeratus*, L. Hand-collection of the pupae and adults and spraying with derris, pyrethrum or arsenates gave the most efficient control.

CHEN (Fong-ge). **Notes on the Biology of *Pseudococcus comstocki* (Kuwana) on *Citrus* (Homopt.).** [In Chinese.]—Yearb. Bur. Ent. Hangchow 5 (1935) pp. 16-35, 21 figs., 14 refs. Hangchow, October 1936. (With a Summary in English.) [Recd. June 1937.]

A detailed account is given of studies of *Pseudococcus comstocki*, Kuw., on *Citrus* in eastern Chekiang, where it is kept in check by natural enemies, including *Telsimia emarginata*, Chapin, *Scymnus* sp. [cf. R.A.E., A 18 320] and a fungus related to *Cordyceps clavulatus*. In the laboratory, 4-5 generations occurred yearly, the adults appearing in June, July, August and September, and October and November. Females laid 48-203 eggs, of which 92-99·9 per cent. hatched. The egg, nymphal, prepupal and pupal stages lasted 0·5-25, 12·29, 1-4 and 2-8 days for the males, and the first two stages 0·5-25 and 17-47 days for the females, the life-cycles of male and female being completed in 24-45 and 62-162 days, respectively. The preoviposition period lasted over 100 days for hibernating females, but only 10-30 days for others, and the oviposition period lasted 15-36 days. Adult males and females lived 2-6 and 26-217 days, respectively.

LIU (Kwo-si) & HWANG (Chuang-chiang). **Life History and Control Measures of *Chondracris rosea* DeGeer in Hangchow.** [In Chinese.]—Yearb. Bur. Ent. Hangchow 5 (1935) pp. 141-148, 6 refs. Hangchow, October 1936. (With a Summary in English.) [Recd. June 1937.]

The locust, *Chondracris rosea*, DeG., which is very destructive to cotton leaves in Chekiang Province, has one generation a year in Hangchow. The hoppers hatch in early June, and after six moults become adult in August. Oviposition takes place ten days after mating, and the winter is passed in the egg stage. Control measures consist in the collection of egg-pods, winter ploughing, poison baits and hand collection of adults in the morning.

CHU (Joo-tso) & CHIN (Shing-mu). **Notes on the Life-History and Control Measures of the Mulberry Twig Borer, *Paradoxecia pieli* Lieu (Lepid.).** [In Chinese.]—Yearb. Bur. Ent. Hangchow 5 (1935) pp. 149-158, 3 figs., 3 refs. Hangchow, October 1936. (With a Summary in English.) [Recd. June 1937.]

Further observations are given on the bionomics of *Paradoxecia pieli*, Lieu [cf. R.A.E., A 24 287], which attacks mulberry in Kiangsu and Chekiang. Only one generation occurs yearly. The immature larvae hibernate in the infested twigs from mid-November to mid-March. The durations of the egg, larval, pupal and adult stages were 19, 311, 31 and 3 days, respectively. The most satisfactory

control (92 per cent. and over) is given by injecting kerosene, diesel, tung-, cottonseed, or bean oil, or extracts of pyrethrum in kerosene, alcohol or water into the last opening made by the larva.

CHU (Joo-tso) & HU (Yung-hsi). **Biological Studies of *Trichogramma evanescens* Westwood (Hym. Trichogrammatidae).** [In Chinese.]—Yearb. Bur. Ent. Hangchow 5 (1935) pp. 164-177, 84 refs. Hangchow, October 1936. (With a Summary in English.) [Recd. June 1937.]

Trichogramma evanescens, Westw., is a common parasite of the eggs of *Dendrolimus punctatus*, Wlk., *Pyrausta nubilalis*, Hb., *Margaronia pyloalis*, Wlk., *Acronycta major*, Brem., and *Diacrisia obliqua*, Wlk., in Kiangsu and Chekiang and was reared from species of *Diatraea* and *Chilo* in Kwangtung. In the laboratory, the following also served as hosts: *Hymenia recurvalis*, F., *Prodenia litura*, F., *Hemerophila atrilineata*, Butl., *Boarmia (Ectropis) obliqua*, Warr., *Arctornis chrysorrhoea*, L., *Rondotia menciana*, Moore, and many other moths. In the field, about 18 generations occurred annually, and the winter was passed in the pupal stage in the host. The shortest life-cycle from egg to adult was completed in 6 days in the eggs of *P. nubilalis* at an average temperature of 90.17°F. and in 26 days in eggs of *D. punctatus* at 66.17°F. Females produced 5-121 adult progeny, up to 33 emerging from a single egg of *D. punctatus*. The adult parasite may live 53 days at 51.52°F., but only about 1 day at temperatures above 85°F. Parasitised eggs of *D. punctatus* have been kept in cold storage for 4 weeks at 40-45°F. when the parasites are about to pupate, and emergence occurred within 24 hours of removal from the refrigerator.

CHEN (Kia-ziang). **Outbreaks of Locusts recorded in Chinese Literature.**—Yearb. Bur. Ent. Hangchow 5 (1935) pp. 188-241. Hangchow, October 1936. [Recd. June 1937.]

An extensive list is given of locust outbreaks recorded in Chinese literature for the period from 707 B.C. to 1935 A.D. They are presumed to refer mostly to *Locusta migratoria* [*manilensis*, Meyen] [cf. R.A.E., A 24 233], although some may refer to local species of grasshoppers, and in the Hunan province, to *Ceracris kiangsu*, Tsai.

Between 960 and 1935, locusts were recorded in 619 years, 88 per cent. of the outbreaks lasting more than a year, and their average duration being 5.5 years. The records do not disclose any periodicity in the outbreaks, which appear to have been most frequent in Hopei, Shantung, Honan and Kiangsu.

BELLER (S.) & BHENCHITR (P.). **A preliminary List of Insect Pests and their Host Plants in Siam. (With Notes on their Injury, Miscellaneous Foods and Utilization of the Host Plants.)**—Tech. Bull. Dep. Agric. Siam no. 1, 68 pp. Bangkok, April 1936. [Recd. June 1937.]

This work, compiled from records kept since 1929, comprises a list of insects arranged according to order, family and food-plants, with the Siamese names of the latter; a list of food-plants arranged by family, with their Siamese names, use in Siam, and English names

(if any), together with the insect pests of each and the nature of the injury; an index to the Siamese names of the food-plants; an index to the scientific and English names of the food-plants; and an index to the list of insect pests.

KALSHOVEN (L. G. E.). **Dermestiden in Nederlandsch-Indië.** 2. Het geslacht *Dermestes*. 3. *Aethriostoma (Telopes) undulata* Mots. [Dermestids in the Netherlands Indies. 2. The Genus *Dermestes*. 3. *A. undulata*.]—*Ent. Meded. Ned.-Ind.* 3 no. 2 pp. 29–33. Buitenzorg, 1st June 1937. (With a Summary in English.)

Dermestes cadaverinus, F., was found in sea-port towns, in cheese and dried fish. *D. frischii*, Kg., breeds in the carcasses of small mammals and in dried meat. *Aethriostoma undulata*, Motsch., lives in bat guano in caves and appears also to breed in the pressed cake made from the refuse of coconut-oil mills. *D. vulpinus*, F., has also been recorded.

FRANSSEN (C. J. H.). **Aanteekeningen over** [Notes on] *Pseudococcus brevipes* Ckll. (Hem., Coccoidea.)—*Ent. Meded. Ned.-Ind.* 3 no. 2 pp. 33–34. Buitenzorg, 1st June 1937.

In a book on pests and diseases of orchids in Java [R.A.E., A 24 391] a species of *Pseudococcus* was recorded as injuring *Phalaenopsis amabilis*. It is here stated to be *P. brevipes*, Ckll., the vector of pine-apple wilt disease, which has recently appeared in Java. This mealybug has also been found on many other food-plants. It is fostered by the black cacao ant, *Dolichoderus bituberculatus*, Mayr, and other ants. It is viviparous, and at Buitenzorg the complete life-cycle took 36 days.

Plant Importation Rules, Malaya, in Force from 1936.—Demy 8vo, 38 pp. Kuala Lumpur, Dep. Agric. S.S. & F.M.S. [1937.]

The plant importation rules issued by the Federated Malay States, the Straits Settlements, Johore, Kedah, Trengganu and Perlis are reprinted. In the case of each State, an identical list is given of plants and plant materials that may only be imported under stated conditions.

LIGHT (S. F.). **A Collection of Termites from Ceylon and Java.**—*Pan-Pacific Ent.* 13 no. 1–2 pp. 15–24. San Francisco, Calif., 1937.

Among the species discussed in these notes is *Calotermes (Cryptotermes) dudleyi*, Banks. The author considers that this species ranges from the Philippines to Ceylon and that the following are synonyms of it: *Cryptotermes (Planocryptotermes) nocens*, Light, *C. primus*, Kemner nec Hill, *C. javanicus*, Kemner, *Calotermes jacobsoni*, Holmgr., and *Cryptotermes jacobsoni*, Kemner.

Sugarcane Borer Control by Cultural Method.—*Mysore agric. Cal.* 1937 pp. 33, 37, 41, 1 pl. Bangalore, 1937.

Experiments have been carried out in Mysore to test the relative value of two cultural measures for the control of the sugar-cane borers, *Diatraea venosata*, Wlk., and *D. (Argyria) sticticraspis*, Hmps. The measures were the removal of the first leaf sheath, and a light earthing

up on both sides of the rows of young canes [R.A.E., A 24 242], and when they were tested separately and in combination on plots of equal area, the first crop yielded $12\frac{3}{4}$, about $11\frac{1}{2}$, and about $13\frac{1}{4}$ tons cane, respectively, and the second $5\frac{1}{2}$, $3\frac{3}{4}$, and about 5 tons. Control plots yielded 9 and about $3\frac{3}{4}$ tons, respectively. In the June crop infestation by the borers seemed to be less severe. Earthing up affords cheap and effective control if started as soon as the plants are four weeks old; it is not necessary to wait until dead-hearts appear.

A new Method of controlling some important underground Insect Pests of Crops.—*Mysore agric. Cal.* 1937 pp. 41, 45, 49. Bangalore, 1937.

Soil fumigation with carbon bisulphide is recommended for the control of white grubs (including *Lachnostenra (Holotrichia) serrata*, F.) that attack sugar-cane, potatoes and other vegetables in Mysore. The carbon bisulphide should be employed in an emulsion containing about $\frac{3}{4}$ oz. with an equal quantity of coconut oil in a solution of $\frac{1}{4}$ lb. bar soap in 1 gal. cold water. The infested area should be irrigated, and the following day the top layer of soil should be removed and the emulsion applied at the rate of $\frac{1}{4}$ gal. for each infested stool. This fumigant is also effective against red ants (*Solenopsis geminata*, F.) and termites, if used in the proportion of 1 oz. carbon bisulphide to each gallon of mixture. In severe cases, treatment may be repeated at weekly intervals.

KELSEY (J. M.). The Ragwort Leaf-miner (*Phytomyza atricornis* Mg.) and its Parasite (*Dacnusa areolaris* Nees.).—*N.Z. J. Sci. Tech.* 18 no. 10 pp. 762–767. Wellington, N.Z., March 1937.

Experiments in New Zealand on the control of ragwort (*Senecio jacobaea*) in insect-proof cages by various imported species of insects were invalidated by attacks of the native leaf-miner, *Phytomyza atricornis*, Mg. [cf. R.A.E., A 24 512], the synonymy of which is discussed. The egg, larval, and pupal stages of this fly usually last less than 7 days, 8–10 days and 7 days, respectively. The duration of the complete life-cycle in 1934 varied from 14 days in February to 51 in July–September, the average temperature and relative humidity in the two cases being 68°F. and 69 per cent. and 49·9°F. and 73 per cent., respectively. Individuals reared on ragwort in cages produced as many as 15 complete generations in a year. The progeny of 5 pairs of adults placed in a cage containing a large healthy plant of ragwort mined the leaves extensively but did not kill them. The larvae of the second generation re-infested the plant and killed it before many of them had fully developed. The progeny of 36 females enclosed with males in a section of the insectary containing 7 strong plants failed to kill any. The second generation killed all the leaves and 3 of the plants, but the remaining 4 sent up new growths, which, with the stocks, were destroyed by the third-generation larvae. The progeny of 10 females, enclosed with males on a single plant, apparently killed it, but a sickly growth of new leaves was produced, which was killed by the second generation. The progeny of 24 females confined with males on two plants killed all the leaves, and the second generation killed all the leaves that arose from the stocks. Thus in a cage, larvae arising from 5 females cannot kill a healthy

plant, but their progeny can do so. In the field, females choose healthy plants in preference to stunted ones for oviposition, but in small isolated patches of ragwort, they would be obliged, unless they migrated, to oviposit on weakened ones.

The effect of *Dacnusa areolaris*, Nees, which has been known to parasitise 40–65 per cent. of the larvae of *P. atricornis*, was tested in the insectary, where several generations of this Braconid were found gradually to reduce the host population. To hasten the control effected by it, leaves containing puparia were collected, and the adults of *P. atricornis* emerging from them were destroyed, while the adult parasites were returned to the insectary. When the third generation was complete, almost all the puparia were parasitised.

The adults of *P. atricornis* live 1–2 weeks longer than the adult parasites, and the parasite takes longer to develop than the host, so that some larvae remain unparasitised; but as the generations of *P. atricornis* overlap, *D. areolaris* is never unable to find a host. When 10 female leaf-miners with males were put with two large ragwort plants in a cage into which 10 female parasites with males were introduced seven days later, 76·5 per cent. of the first-generation larvae and 96·25 per cent. of the second were parasitised. The plants, which were mined extensively by the first-generation larvae and to a certain extent by the second generation, eventually recovered and produced flower-heads. A strong ragwort plant in a cage in which 10 females of *P. atricornis* and 5 female parasites were liberated with males of each was destroyed before many of the larvae were fully developed. Of those that pupated, 33·33 per cent. were parasitised. Two healthy plants in a cage in which 40 female leaf-miners and 10 female parasites were placed with males of each were greatly weakened by the first-generation larvae, among which parasitism was 62·11 per cent., but recovered during the pupation period. Parasites continued to emerge for 10 days after emergence of *P. atricornis* had ceased. The second-generation larvae killed all the leaves on one plant, but the other recovered. The percentage of parasitism in this generation was 98·04.

Destruction of Ant-nests in Bowling-greens.—N.Z. J. Agric. 54
no. 4 p. 237. Wellington [N.Z.], April 1937.

For the control of ants in lawns, it is recommended that holes, 8–12 ins. deep, should be bored about the nest, one tablespoonful of carbon bisulphide poured into each, the holes covered with moist earth, and the top of the nest with wet sacking. Alternatively, calcium cyanide in dust form may be applied through a funnel, at the rate of one teaspoonful per hole, to the bottom of holes 2–3 ins. apart made in and around the nest, and the holes filled with earth.

EVANS (J. W.). The Lucerne Flea.—Tasm. J. Agric. 8 no. 2 pp. 93–98,
3 figs., 3 refs. Tasmania, May 1937.

About 14 years ago the lucerne springtail, *Smynthurus viridis*, L., was introduced into Tasmania, where it causes extensive damage to pastures, especially those sown with subterranean clover, *Trifolium subterraneum*. The eggs do not hatch in dry soil [R.A.E., A 20 556], and temperatures above 60°F. are unfavourable to the development and survival of the nymphs. A map of the island,

based on work by Davidson [22 448], shows the areas favourable to population increases. On the north-west coast, samples taken for two seasons showed that, although the adult insects were absent during the winter, both early and late nymphs were abundant. Charts show that there is a sudden increase in numbers towards the end of May, when the eggs laid by the first generation have hatched, and a sudden drop in numbers in mid-December. The winter population in 1936 appeared to be greater than that in 1935, and it is thought that the higher temperatures recorded for May may have accelerated development. In the spring of 1936, the population was, however, lower than in 1935, suggesting that the abnormally high rainfall in 1936 may have destroyed large numbers of the third generation. Adequate control can be secured with two applications of lime-sulphur [21 407], and it is recommended that the first be made either during May or the first half of June, the pasture being closely grazed before treatment, and the second from August to mid-October. Dusting experiments with sulphur and a mixture of sulphur and pyrethrum gave promising results in the laboratory but not in the field. The predatory mite, *Biscirus lapidarius*, Kramer, was introduced from Western Australia in 1934 and appears to have become an important factor in reducing the intensity of infestation [24 378, etc.].

WALLACE (C. R.). **The Yellow *Monolepta* Beetle. Control Methods.**—*Agric. Gaz. N.S.W.* **48** pt. 5 pp. 268–269, 1 fig. Sydney, May 1937.

Severe damage was caused by the Galerucid, *Monolepta rosea*, Blkb., to maize, *Citrus*, stone and small fruits, French beans and many flowering plants in New South Wales in 1936. Control by flares and sprays of lead arsenate was unsatisfactory [*cf. R.A.E.*, A **25** 322]. Sprays of nicotine sulphate, 1 : 640, a mixture of 1 fl. oz. pyrethrum and 2 fl. oz. nicotine sulphate in 8 gals. of water, and one of 1 fl. oz. pyrethrum extracts in 4 gals. of water, all with 1 per cent. white oil as spreader, were ineffective, but the last two temporarily paralysed the beetles, which dropped to the ground. When the foliage spray of pyrethrum extract was followed by a ground spray of tar distillate, 1 : 20, excellent results were obtained, and the pyrethrum extract spray at double the strength, without the ground spray, was also promising. The best and most economical results, giving a mortality rate of about 90 per cent., were, however, obtained by applying pyrethrum dusts, either undiluted or mixed with equal parts of a 3 per cent. nicotine dust (by volume), or kaolin (by weight), the last being the cheapest. Within a minute or two of dusting, most of the beetles are paralysed and fall to the ground, and it is thought that if some additional dust is then applied to them the percentage mortality will be increased.

MOUTIA (A.). **Entomological Division.**—*Rep. Dep. Agric. Mauritius* 1935 pp. 30–33. Port Louis, 1936. [Recd. June 1937.]

In 1935, adults of *Lachnostenra (Phytalus) smithi*, Arr., were collected in greater numbers than in 1934 [*R.A.E.*, A **24** 287], but although in some localities infestation had spread outwards from the old centres, no new ones were observed. Sugar-cane was severely infested by *Diatraea venosata*, Wlk., in the lowlands in the south of the island,

nearly all the canes in some fields being attacked. Parasitism by *Apanteles flavipes*, Cam. (*simplicis*, Vier.) and *Henicospilus antakarus*, Sauss., reached 24 and 1 per cent., respectively. *Argyroploce rhynchias*, Meyr., damaged 15 acres of canavalia beans (*Canavalia ensiformis*). All plants found infested were immediately destroyed. An unidentified Tachinid parasitised about 5 per cent. of the larvae. In one district, *Gryllotalpa africana*, P. de B., attacked about 20 per cent. of the potato tubers. Baits containing zinc sulphide or Paris green gave some control. The use of grease bands on fruit trees infested with *Icerya seychellarum*, Westw., prevented the ant, *Technomyrmex albipes*, F. Smith, from fostering it, while allowing free development of Coccinellid predators, but could not stop the same ants fostering *Aspidirotus destructor*, Sign., on coconut. *Opicus phaeostigma*, Wlkn., which was imported from South Africa [cf. 24 240] against *Dacus ciliatus*, Lw., and *D. emmerezi*, Bezzi, attacked them in the insectary.

BOURIQUET (G.). Madagascar : Phytopathological and Entomological Notes.—*Int. Bull. Pl. Prot.* 11 no. 6 pp. 118–119. Rome, June 1937.

In October and November, 1935–36, experiments were undertaken on the control of the Hispid, *Trichispa sericea*, Guér., which causes considerable damage to transplanted rice in Madagascar when the rains are delayed at the end of the dry season. As observations showed that serious infestation first occurs in the nurseries, control measures should be carried out before the young rice plants are transplanted. Pyrethrum preparations or an emulsion of 5 gals. kerosene and 25 lb. soap in 100 gals. water are effective against the adults. To kill the larvae, which mine most frequently in the tips of the leaves, these should be destroyed, or bundles of seedlings may be immersed for 15–30 seconds in boiling water up to the level of the binding, without harming the plants. If the insects appear on the transplanted rice, the fields should be submerged, where possible, for 48 hours, or instead, gas oil should be poured over the infested areas at the rate of about 1 gal. per acre, and, when the liquid has spread, the plants should be beaten with bamboo sticks two or three times at intervals of 15 minutes. A considerable proportion of the insects was thus destroyed under experimental conditions.

[**Jowari Pests in Somaliland.**]—*Rep. vet. agric. Dep. Somaliland* 1936 p. 16, multigraph. [? Berbera, 1937.]

The Pentatomid, *Agonoscelis versicolor*, F., and a species of *Sesamia* were both recorded in 1936 for the first time infesting jowari [*Sorghum*] in the Somaliland Protectorate. The moth caused considerable damage and as it overwinters in the stalks, field sanitation is essential for its control.

DE SAEGER (H.). L'Apanteles sagax Wilkn parasite de la pyrale du cotonnier.—*Bull. agric. Congo belge* 28 no. 1 pp. 147–150, 1 fig., 1 ref. Brussels, March 1937.

The larva and adult of *Apanteles sagax*, Wlkn., which is the most abundant and effective parasite of *Sylepta derogata*, F., on cotton in the Belgian Congo, are briefly described. Oviposition takes place at

dusk or during the night. The adult deposits several eggs singly in a mature larva of the Pyralid. In the laboratory, one female laid 12–32 eggs, but the number of larvae emerging from a single host would appear to indicate that many more may be laid, unless more than one female oviposits in the same host, which is improbable, as all the parasite larvae from one caterpillar emerge simultaneously. In the laboratory, the larvae, which feed only on the fatty matter of the host, passed 5–7 days within it, during which time it moved and fed very little. Emergence always takes place in the morning and lasts 25–30 minutes. Without leaving the remains of the host, the larvae spin a protective cover under which they immediately make cocoons, taking 10 hours to do so. As many as 70 parasites have been counted on one host. The pupal period lasts four days, and the adult emerges during the night between the fourth and fifth day after the larva leaves the host. Pairing takes place a few hours later, and oviposition probably during the next two or three days. *A. sagax* is itself parasitised by *Calliceras* sp. and *Syntomosphyrum phaeosoma*, Wstsn.

[SKORIKOV (A. S.).] Скориков (А. С.). Present State of the Problem of the Pollination of cultivated Plants by Insects. [In Russian.]—*Trav. Inst. zool. Acad. Sci. URSS* 4 livr. 1 pp. 1–70, 15 figs., 27 refs. Moscow [1937].

Owing to the considerable and steady increase in areas in the Russian Union in which red clover, orchards and small fruits are being cultivated, pollination is exceeding the capacity of local wild insects; the efforts of the latter should, therefore, be supplemented by the introduction of honey bees. The history of the work carried out in Russia since 1908 in connection with the use of Caucasian races of bees for the pollination of red clover is reviewed, and the value of other insects, especially bumble-bees, in the pollination of different crops is discussed. Different methods of placing the hives to secure an even distribution of a sufficient number of honey bees for pollination are discussed, and it is pointed out that as hardly any cultivated entomophilous plants produce sufficient nectar and pollen to maintain an adequate number of pollinators through the year, supplementary crops that flower before and after the main crop should be cultivated.

[DOMBROVSKAYA (E. V.).] Домбровская (Е. В.). Matériaux pour servir à l'étude des Cécidomyides de la faune de l'URSS. II. Cécidomyides de la région occidentale de la partie Européenne de l'URSS. [In Russian.]—*Trav. Inst. zool. Acad. Sci. URSS* 4 livr. 1 pp. 117–147, 18 figs. Moscow [1937]. (With a Summary French.)

Investigations on Cecidomyiids were carried out in the summer of 1934 in a forest reserve in the Western Province in European Russia covering an area of 86,450 acres (including 17,290 acres of sphagnum swamps) and mainly consisting of spruce with an admixture of birch, aspen and willows. An annotated list is given of the 57 species found. The characters of the galls formed are discussed, and in many instances descriptions of the larvae found in them are given, as well as notes on the biology of some of the species as observed in the laboratory.

GRASSÉ (P. P.). **Parasites et Parasitisme.**—17·5 × 11 cm. 224 pp., 26 figs., 13 refs. Paris, A. Colin, 1935. Price 3s. [Recd. August 1937.]

This work is divided into nine chapters dealing with definition, limits and manner of parasitism, morphology of parasites, life-cycles, processes of reproduction, physiology of parasites, reciprocal action of parasite and host, parasitism within the species, connection of parasitism with social phenomena, and adaptation and evolution in parasitism. In each chapter there are notes on insects, or a section devoted to them.

[STARK (V. N.)] Старк (В. Н.). **Results of Work in Forest Entomology carried out on the Territory of the Leningrad Province during the Period from 1842 till 1934 inclusive.** [In Russian.]—Bull. Sta. rég. Prot. Plantes Leningr. 7 pt. 1 pp. 3–64, 10 pp. refs. Leningrad, 1936. [Recd. 1937.]

This paper comprises a review of Russian literature, including investigations of the author and unpublished material. A section (pp. 8–38) deals with the bionomics and, in some cases, the control of various forest pests, including *Aradus cinnamomeus*, Panz., *Hylobius abietis*, L., *Pissodes piniphilus*, Hbst., and *Melolontha hippocastani*, F., on pine, *Anthonomus pubescens*, Payk., and *Serropalpus barbatus*, Schall, on spruce, and *Cryptorrhynchus lapathi*, L., on *Salix viminalis* and alder. There are also short chapters on pests of fruits and seeds, willow, timber in buildings, and parks in Leningrad.

[ZORIN (P. V.)] Зорин (П. В.). ***Eulophus pectinicornis* L. an external Parasite of the Larvae of Noctuids.** [In Russian.]—Bull. Sta. rég. Prot. Plantes Leningr. 7 pt. 3 pp. 2–12, 8 figs., 4 refs. Leningrad, 1936. [Recd. 1937.]

Detailed observations on *Eulophus pectinicornis*, L., which parasitises Noctuids, were carried out in the environs of Leningrad in 1924–31. The hosts attacked in the field and in the laboratory are given, and the eggs, larvae and pupae of this Eulophid are described. The eggs are deposited in the folds on the skin of the paralysed host larva, only mature individuals usually being attacked. Examination of the ovaries and counts of the progeny of females bred in the laboratory showed that on an average one female gives rise to 140 larvae and parasitises 2–5 host larvae. The number of parasite larvae that developed on a host varied from 6 to 117. The eggs of unfertilised females gave rise to males only. The mature larvae of the parasite abandon the host and pupate close to it. In the laboratory at 17–19°C. [62·6–66·2°F.] and a humidity of 50 per cent., the life-cycle of the parasite from egg to adult was completed in 29–32 days, of which the egg stage lasted 6–8 days, the larval 10 and the pupal 13–14; at 23°C. [73·4°F.] and a humidity of 50 per cent., development was completed in 19–20 days, the eggs, larvae and pupae maturing in 4, 6 and 9–10 days, respectively.

In warm springs, the parasite appeared in the field in mid-May, and parasitised Noctuid larvae were found in late May, young adults emerging between 30th June and 2nd July. In the second half of June and in July, the life-cycle lasted 24–26 days, and in August

33-34. In a warm summer, therefore, the parasite apparently produces three complete generations and probably a partial fourth. The first generation develops from late May to late June on the larvae of *Polia (Aplecta) nebulosa*, Hfn., and *Naenia typica*, L.; the second develops in July on a large number of Noctuids; the third is present in August and September, and the fourth in September and the first half of October, on the larvae of *Polia oleracea*, L., *P. suasa*, Schiff., *P. pisi*, L., and *Barathra brassicae*, L. Most of the pupae of the third generation and all those of the fourth go into a diapause and hibernate. Two generations [cf. R.A.E., A 17 589] apparently occur in cold years.

[ZORIN (P. V.). Зорин (П. В.). A few Data on the Biology of *Pteromalus puparum* L. and its Utilisation in the Control of the Cabbage and Rape White Butterflies. [In Russian.]—Bull. Sta. rég. Prot. Plantes Leningr. 7 pt. 3 pp. 13-17, 2 refs. Leningrad, 1936. [Recd. 1937.]

In the environs of Leningrad, the adults of *Pteromalus puparum*, L. [cf. R.A.E., A 20 88] appear in the spring from the second half of May till the end of June, depending on the weather. In the warm years, 1926, 1930 and 1931, there were three generations and a partial fourth. The first developed in the pupae of *Vanessa urticae*, L., on nettles, the adults emerging in mid-July and attacking the pupae of the cabbage butterflies, *Pieris (Mancipium) brassicae*, L., and *P. (M.) rapae*, L. The second-generation adults had all emerged by mid-August. They chiefly oviposited in the pupae of the second generation of *V. urticae* and the few pupae of the cabbage butterflies that were still present in the field. Some of the attacked pupae hibernated, together with a few parasitic larvae, and some produced adult parasites, forming the third generation. These oviposited in pupae of the second generation of the cabbage butterflies; the larvae of the partial fourth generation of the parasite developed in September and the first half of October, and all entered hibernation within the host pupae. At 23-24°C. [73.4-75.2°F.] the life-cycle was completed in 19-20 days, and at 17-19°C. [62.6-66.2°F.] in 33-36 days.

It is suggested that in the Leningrad district the economic importance of this Pteromalid could be increased by planting strips of nettle and rearing larvae of *V. urticae* on them to secure its presence, even if larvae of the first generation of *Pieris* are reduced in numbers. This measure would also attract the Tachinid, *Phryxe vulgaris*, Fall., the first generation of which develops in the larvae of *V. urticae*, but which later attacks those of *Pieris*.

[ZORIN (P. V.).] Зорин (П. В.). The Importance of the Parasites of the Cabbage Noctuid in the Leningrad Province. [In Russian.]—Bull. Sta. rég. Prot. Plantes Leningr. 7 pt. 3 pp. 18-20, 4 refs. Leningrad, 1936. [Recd. 1937.]

Only five parasites of the cabbage moth [*Barathra brassicae*, L.] have been recorded from the Leningrad district. Of these, the Ichneumonid, *Exostastes cinctipes*, Retz., suffers from hyperparasites, and *B. brassicae* is not, apparently, its chief host; *Eulophus pectinicornis*, L., does not occur in kitchen gardens in the first half of summer owing to the absence of hosts for its first two generations;

Trichogramma evanescens, Westw., is often killed by unfavourable climatic conditions; and the Tachinid, *Bucentes geniculata*, DeG., the chief hosts of which are Tipulid larvae, is only gradually becoming adapted to the cabbage moth. The Tachinid, *Ernestia consobrina*, Mg., alone is of economic importance [cf. R.A.E., A 16 367] and it prefers *B. brassicae* to any other of its Noctuid hosts. In 1931 the rate of parasitism of the larvae by *E. consobrina* in a kitchen garden in Leningrad between the 2nd and 12th August amounted to 88·2 per cent.; in the second half of the month, however, this percentage decreased to 52·9, and no parasitised larvae were found after the 26th. As the activity of the Tachinid ceases in the field before that of the larvae of the cabbage moth, a number of which pupate, artificial breeding of the parasite is recommended. During laboratory investigations, 375 and 481 larvae, respectively, were produced by two females, and in several others that were dissected, the number of eggs varied from 856 to 984. *E. consobrina* should, however, be considered only as supplementing spraying or dusting in the first half of July.

[ZORIN (P. V.).] Зорин (П. В.). The Application of Naphthalene for the Control of Pests of Cucumbers in Frames. [In Russian.]—Bull. Sta. reg. Prot. Plantes Leningr. 7 pt. 4 pp. 3–12, 8 figs., 6 refs. Leningrad, 1936. [Recd. 1937].

An apparatus is described for fumigating with naphthalene against the red spider, *Tetranychus* (*Epitetranychus*) sp., on cucumbers in frames, since those previously constructed [cf. R.A.E., A 18 578; 22 106] can only be used in greenhouses. It consists of a rectangular wooden box, 38 ins. long, 14 ins. wide and 10 ins. high, divided into compartments by two wooden partitions in the middle that are attached to the top of the box at an angle of 75°, the distance between them there being 6 ins., and their lower ends being $1\frac{3}{4}$ ins. from the bottom. The central compartment contains an electric fan. The two side compartments each contain four removable shelves, on which and on the bottom of the box single layers of naphthalene lumps are placed, the total quantity used being $26\frac{1}{2}$ lb. When the fan is set in action, air is drawn into the outer compartments through two slits at the top, it then travels over the naphthalene on the shelves and floor into the middle compartment, whence it is driven by the fan into two tubes under the lid to two small openings in the ends, through which it is finally expelled.

Fumigation experiments carried out in frames of different size with cucumbers artificially infested with adults of *Tetranychus* showed that the apparatus was effective in spaces not exceeding 175 cu. ft. A concentration of 30–32 oz. naphthalene per 1,000 cu. ft. at a temperature of 25–30°C. [77–86°F.] killed 98·3–99 per cent. of the mites in sunny weather in 4 hours, and 97·4 per cent. in 7 hours on cloudy days at a temperature of 22–23°C. [71·6–73·4°F.]. On cold nights when the temperature in the frames fell to 18°C. [64·4°F.] or less, a mortality of 98·4 and 99·7 per cent. was attained with exposures of 17 and 18 hours, respectively. This high concentration of naphthalene was required as the frames were not air-tight. In experiments with *Thrips tabaci*, Lind., on cucumbers, all the thrips were killed in 4 hours at 26–30°C. by the same concentration as used against the red spider.

To determine the effect of the fumigation on the eggs of *Tetranychus*, sample leaves from treated plants were examined daily in the laboratory. Some eggs hatched 4 or 5 days after the fumigation, but those in which the development of the larvae had already begun did not.

No scorching of the plants was observed provided that they were well watered and the frames were covered on sunny days.

In the Leningrad district, cucumbers in frames should be fumigated from the middle of June to the middle of July.

SIEMASZKO (W.). *Studies on entomogenous Fungi of Poland.* [In Polish.]—*Arch. Nauk biol.* 6 fasc. 1 pp. 1-83, 7 figs., 3 pls., 4 pp. refs. Warsaw, 1937. (With a Summary in English.)

This monograph deals extensively with the entomogenous fungi of the genus *Beauveria*, with particular reference to the species occurring in Poland. The author considers that most of the species described as attacking insects are biological races of *B. bassiana*, *B. globulifera* or *B. densa* [cf. R.A.E., A 14 404], all of which have been recorded in Poland. They appear on insects in a number of strains that differ by their structure in cultures. The difference apparently depends on the host, since a strain from a given insect retains its original appearance after passing through other species of insects and after transfer to artificial media. Three strains of *B. bassiana*, obtained from larvae of *Cossus cossus*, L., and *Cydia (Carpocapsa) pomonella*, L., and adults of *Orthopleura sanguinicollis*, F., were reared by the author in the laboratory. *B. globulifera* occurred in two forms, one of which coloured potato slabs and was found on several species of Scolytids and other insects, including *C. pomonella*. The other did not colour potato slabs and attacked *Hylobius abietis*, L., *Acanthocinus aedilis*, L., *Diprion (Lophyrus) pini*, L., *Hylastes (Hylurgops) palliatus*, Gyll., and *C. pomonella*. *B. densa*, the synonymy of which is discussed, was found on *Melolontha melolontha*, L.

From experiments with species of *Beauveria* not occurring in Poland, it is concluded that *B. stephanoderis* is a strain of *B. bassiana* that, under tropical conditions, has become adapted to the coffee beetle, *Stephanoderes hampei*, Ferr.; *B. effusa*, described from France on silkworms [*Bombyx mori*, L.], *Leptinotarsa decemlineata*, Say, and *Phthorimaea operculella*, Zell., is a series of strains of the form of *B. globulifera* that colours potato, and *B. doryphorae*, described from France on *L. decemlineata*, is a strain of the form of *B. globulifera* not colouring potato. *B. vexans*, found on the larvae of *Lachnostenra* in North America, and *B. delacroixii*, found on migratory locusts in Algeria, are probably races of *B. globulifera*; and *B. brongniartii*, found on migratory locusts in Algeria, is a race of *B. densa*.

In infection experiments with *Spicaria* spp., larvae of *Lymantria (Liparis) dispar*, L., *Cydia (Carpocapsa) pomonella*, L., and *Celerio (Deilephila) euphorbiae*, L., were easily infected when dusted with the spores.

Metarrhizium anisopliae was observed in Poland for the first time in 1935 on the adults of *M. melolontha* and those of *Anomala dubia* var. *aenea*, DeG.

An alphabetical list of insects that are attacked by these parasitic fungi in Poland or other countries is given, and an index to the species of fungi and their synonyms is appended.

KARPIŃSKI (J.). **Próby walki z chrabąszczem (*Melolontha* sp.) za pomocą grzyba *Beauveria densa* Pic.** [Experiments on the Control of the Cockchafer (*Melolontha* sp.) by means of the Fungus *Beauveria densa* Pic.]—*Roczn. Nauk rol.* **41** no. 2 pp. 383–386, 1937. [With a Summary in German.] (Abstr. in *Rev. appl. Mycol.* **16** pt. 8 p. 530. Kew, Surrey, 1937.)

In laboratory experiments in 1934–35, *Melolontha melolontha*, L., proved much less resistant to infection with *Beauveria densa* than *M. hippocastani*, F., as indicated by the length of the relative survival of the two species after infection; in the end, however, all the experimental insects perished, and *B. densa* was recovered from all the bodies. The fact that in both species infected females laid few or no eggs was confirmed in field experiments. In a forest in which an infection focus of *B. densa* was artificially established, the percentage of dead cockchafers infected by the fungus was found to be 24·5 within 1 km. of the focus, 19·2, 11·2 and 5·8 at distances of 1–2, 2–3 and 3–4 km., and 0 at 7 km. The infection, however, did not penetrate through the soil to the grubs.

MOTAS (C.) & ZAHARESCO (V.). **Sur la biologie du *Lyonetia clerckella* L. et les moeurs de sa chenille.**—*Bull. Acad. Roumaine* **17** (1935–36) pp. 60–70, 1 pl., 5 figs., 7 refs. Bucarest, 1936. [Recd. August 1937.]

In 1933–34 there was an outbreak in northern and central Moldavia of the Tineid, *Lyonetia clerkella*, L., the adult, larva and pupa of which are here described. The plants attacked were *Prunus* spp., *Pyrus* spp., *Cydonia vulgaris*, *Betula verrucosa* and *Corylus avellana*, the larvae mining in the leaves. The life-history is compared with that in Sweden [cf. *R.A.E.*, A **14** 612] where there are 2–3 generations a year, whereas in Moldavia 3 generations occurred in 1934. The same parasites are recorded in Moldavia as in Sweden [cf. loc. cit.].

RIEHM (E.). **Das Gesetz zum Schutze der landwirtschaftlichen Kulturpflanzen vom 5. März 1937.** [The Law for the Protection of cultivated Plants of 5th March 1937.]—*Anz. Schädlingsk.* **13** no. 6 pp. 69–71. Berlin, June 1937.

The author describes and discusses the German Plant Protection Law of 5th March 1937 [*R.A.E.*, A **25** 404].

SCHIMITSCHEK (E.). **Die Bekämpfung der Weidenschaumzikade *Aphrophora salicis* Fall.** [The Control of the Cercopid, *A. salicis*, DeG.]—*Anz. Schädlingsk.* **13** no. 6 pp. 72–77, 10 figs., 3 refs. Berlin, June 1937.

Willows planted on the banks of the River Enns, Upper Austria, have been severely attacked by the larvae of the Cercopid, *Aphrophora salicis*, DeG., which pierce and suck the rods, the horizontal rows of punctures causing swellings clearly visible in peeled rods, which break at these points when bent. *A. salicis* lays its eggs in batches between the bark and the wood in dead rod tips or in rod stumps, never in living green rods. It attacks only the branches and aerial portions of the rods, whereas *Philaenus leucophthalmus*, L. (*spumarius*, auct.) occurs on stems left after rod cutting and on young rods at, or, more frequently, just below ground level.

In May and June 1936 several insecticides, mostly proprietary, were tested, the results being tabulated and discussed. When 2–4 blasts of a Calcid (calcium cyanide) dust from a special hand duster were directed against any colony of larvae, hydrocyanic acid gas was generated by reaction with the water in the larval froth, so that all the larvae were killed in 3–5 minutes. The hand duster used has a chamber in which a Calcid tablet is held so that about 1/400 part (equal to about 0.025 gm. hydrocyanic acid gas) is scraped off and blown out by each stroke of the bellows. The operator requires a gas mask. Of the other sprays and dusts tested, three proprietary sprays, a pyrethrum extract, a pyrethrum emulsion, and a preparation of nicotine, oil and soap, proved satisfactory. Preventive measures advocated are cutting the rods as low down as possible to allow the stumps to be covered with earth, thus depriving the insect of sites for oviposition, and the removal of neighbouring wild willows.

Roos (K.). Untersuchungen über die Fritfliege (*Oscinella frit* L.) und ihr Auftreten in verschiedenen Höhenlagen der Schweiz. [Investigations on the Frit Fly, *O. frit*, and its Occurrence at various high-lying Localities in Switzerland.]—*Landw. Jb. Schweiz* 51 no. 6 pp. 585–666, 49 figs., 2 pp. refs. Bern, 1937.

All stages of *Oscinella frit*, L., are described, and various aspects of its bionomics and control are recorded in considerable detail, with separate summaries to each section.

The following is taken mainly from the general summary. Net sweepings and laboratory breeding showed that in all localities there was a regular occurrence of *O. frit* (which predominated), *O. pusilla*, Mg., and transition forms between them. Infestation was considerable in all of seven test plots of oats sown in different localities at altitudes from approximately 1,400 to 6,100 ft. The various forms of larval injury are described. The chief injury to oat grains occurred up to about 3,000 ft. with late sowing, whereas at 4,700–6,100 ft. they were rarely injured. Injury to barley occurred chiefly in varieties with four rows of grains. The number of generations in 1934 varied from 1 to 4 according to the altitude. Only slight differences in infestation occurred with different varieties of oats. *O. frit* oviposited on most cereals in a suitable condition of development, late sown ones other than oats developing the same percentage of infestation as oats. Larvae of various generations lived in summer in fodder grasses. Couch grass [*Agropyrum repens*], in particular, provided with its subterranean runners favourable conditions for hibernating larvae, which was the only stage in which hibernation occurred. Oviposition ceased in September, with an average day temperature under 12°C. [53.6°F.]. The last adults oviposited on young winter crops or, failing these, on grasses. Prolonged cold killed the young larvae and then the old ones.

Early spring sowing or late autumn sowing is advocated, and in districts where injury is severe, sowing should be denser than usual. Uniform drill sowing brings the oat crop most rapidly past its critical stage, and this is assisted by a quick-acting nitrogenous manure.

Parasites found were the Pteromalids, *Trichomalus cristatus*, Först., *Halticoptera aenea*, Wlk. (*fuscicornis*, Wlk.) and *Callitula bicolor*, Spin.; the Cynipids, *Eucoila (Rhoptromeris) eucera*, Htg., *Cochonaspis (Hexaplasta) hexatoma*, Htg., and *Eucoila* sp.; and the Prototrupid,

Loxotropa tritoma, Thoms. *E. eucera*, *T. cristatus* and *H. aenea* were the most important, occurring in all seven localities and having percentages of parasitism of 52.2–71.5, 15.8–39.2, 3.7–13.7, respectively.

ROCCI (U.). **La "Zigena della vite" ed alcune specie italiane del gen. *Procris* L. (s. l.). (Lepidoptera Zygaenidae).** [The Grape Vine Zygaenid and some Italian Species of *Procris*.]—*Boll. Ist. Ent. Bologna* **9** pp. 113–152, 11 figs. Bologna, 20th May 1937.

In the historical notes forming the first part of this paper *Theresimima* (*Theresia*) *ampelophaga*, Bayle, is shown to be the true "grape-vine Zygaenid." It is owing to early confusions that this very rare species is still classed as an important pest of Italian vineyards. Over a period of years only a few and limited cases of injury by it have been recorded. The second part discusses the classification and characters of the more common or important Zygaenids attributed to the genera *Rhagades* and *Procris* that have been confused with it.

GÓMEZ-MENOR ORTEGA (J.). **Cóccidos de España.**—Roy. 8vo, xi + 432 pp., 136 figs. Almería, Estac. Fitopat. agríc., 1937.

This monograph has a short general section (pp. 1–31) on the morphology, biology, economic importance, geographical distribution in Spain, collection, preparation and preserving of Coccids. The main section contains keys to the subfamilies, genera and species, and descriptions of the latter, with notes on synonymy, food-plants, distribution in Spain, and recorded natural enemies.

COLEBROOK (F. M.). **The aural Detection of the Larvae of Insects in Timber.**—*J. sci. Instrum.* **14** no. 4 pp. 119–121, 2 figs. London, April 1937.

A description is given of the construction and operation of an apparatus for detecting destructive insects in small pieces of timber by means of the faint noises they make. Preliminary work by Bainbridge-Bell showed that although there was little possibility of applying this method in general to the timber of buildings [*cf. R.A.E.*, A **25** 404] or to growing trees, the intensity of the sounds being too far below the general noise level, it was applicable to the examination of small specimens of timber contained in a sound-proof box. The equipment consists of an earpiece of piezo-electric headphones laid in contact with the piece of timber, which is placed in a sound-proof container, and connected with a high-gain audio-frequency amplifier designed to have a minimum of "background" noise. In a test of two specimens, one of which contained no insects, it was found that the noises made by the larvae could be readily and clearly distinguished from the more uniform background noise of the amplifier. At full gain, the noises made by the larvae were brought to loud-speaker intensity.

CHAMBERLAIN (R.), SKILLMAN (E. E.) & STEWART (J. H.). **The Control of the Carrot Fly (*Psila rosae*) in Northern Ireland.**—*J. Minist. Agric. N. Ireland* **5** pp. 39–51, 2 pls. Belfast, 1937.

A detailed account is given of a series of experiments carried out from 1932 to 1936 on the control of *Psila rosae*, L., on carrot in Northern

Ireland. The adult flies appear in April and May and deposit their eggs singly or in clusters in the soil immediately surrounding the young seedling carrots. The larvae usually hatch within 14 days and make their way to the developing taproot, feeding at first on the outer tissues and later burrowing into the interior of the developing roots, and tunnelling in the surface layers. After about 4 weeks, they pupate in the soil close to the affected roots. The pupal period varies considerably. Larvae may be found from the latter part of May until early in the following spring, although most of the insects overwinter as pupae. There are probably 3 generations annually.

When the taproots are eaten through, the plants die if young, but generally survive if older, though they become stunted and often unmarketable. Celery, parsley and parsnips may also be attacked. Of repellents tested to prevent oviposition near the carrots, crude naphthalene applied at the rate of 1 cwt. per acre was the most effective. In 1935, 4 and 9 weekly applications reduced infestation from 35·4 to 18·4 and 5·7 per cent. respectively, and in 1936, 10 weekly applications on 2 series of plots reduced it from 82·9 to 13·2 and from 95·5 to 6·3 per cent. Other repellents tried were a 1 per cent. solution of tar distillate, an insecticidal solution of mercury bichloride, 1 oz. in 10 gals. water, a mixture of cresylic acid and chalk dust, and a proprietary mixture of orthodichlorobenzene and paradichlorobenzene. With the first two, the foliage was injured, and with the last two, although infestation was considerably reduced, the cost was prohibitive.

The incidence of attack was markedly diminished when the carrot seed was sparsely sown, as this obviates the necessity for thinning, which tends to intensify the attraction of the crop for the fly, as well as loosening the soil and making it more suitable for oviposition. Crops should be grown in rotation to lessen the chances of building up infestation. Dressings of naphthalene should be first applied when the carrots are seedlings, and especially immediately before or during thinning and weeding operations.

ROEBUCK (A.). **The Cabbage Stem Flea Beetle** (*Psylliodes chrysocephala*, L.).—*Derbysh. Fmr* 17 no. 5 pp. 169-170. Derby, May 1937.

Cabbages in Derbyshire were severely infested by *Psylliodes chrysocephala*, L., during 1935-36. Eggs were laid in the soil near young plants. Oviposition, although possibly beginning in September, was observed intermittently from October to the following May, but eggs laid after January did not mature until the crops had been destroyed or harvested. Up to about six larvae burrow into the core of a single stem and either kill or fatally weaken the plant. After March, pupation occurs in the soil, and adults emerge in May and June. In both years the worst damage was done in mid-July, when the adults swarmed over the plants, riddling the leaves and barking the stems, a form of injury not previously observed in England. The little foliage that remained was dry.

The cabbages attacked by larvae were ploughed in, and against the adults, dusts of derris and barium fluosilicate and sprays of lead arsenate were employed. The winter of 1936-37 was unfavourable to the pest, so that crops were not attacked in the following spring.

EVANS (A. C.). **Insect Pests at Rothamsted and Woburn, 1936.**—
Abridg. Rep. Rothamst. exp. Sta. 1936 pp. 117–118. Harpenden
[1937].

Of the insect pests observed during 1936 on the fields of Rothamsted experimental station, the most important was *Helophorus nubilus*, F., which caused severe damage to the wheat plots in February. When these were resown with spring wheat, they were not attacked.

JOHNSON (C. G.). **The Biology of *Leptobyrsa rhododendri* Horvath (Hemiptera, Tingitidae), the Rhododendron Lacebug. II. Feeding Habits and the Histology of the feeding Lesions produced in Rhododendron leaves.**—*Ann. appl. Biol.* **24** no. 2 pp. 342–355, 3 pls., 24 refs. Cambridge, May 1937.

Brief mention is made of the plants attacked by *Stephanitis (Leptobyrsa) rhododendri*, Horv., in England [R.A.E., A **24** 549] and of the problem of immunity and susceptibility of rhododendrons to attack by this Tingid [19 486]. The feeding method generally consists in rupturing an epidermal cell and repeatedly probing the leaf tissues with the stylets, which remain in the original epidermal puncture; less commonly, the epidermis is punctured but no probing takes place. The character and histology of the lesions produced by both these methods are described in detail.

BARNES (H. F.). **Methods of investigating the Bionomics of the common Crane-fly, *Tipula paludosa* Meigen, together with some Results.**—*Ann. appl. Biol.* **24** no. 2 pp. 356–368, 1 pl., 3 refs. Cambridge, May 1937.

An investigation into the bionomics of *Tipula paludosa*, Mg., infesting grasslands in England is described [cf. R.A.E., A **5** 361].

The following is largely the author's summary: Full-grown larvae of *Tipula paludosa* were obtained by application to the soil of an emulsion of orthodichlorobenzene [cf. **25** 208], and it is suggested that the larvae become non-susceptible to this treatment about six weeks before pupation. The larvae were reared in pots of soil containing germinating and growing wheat. The adult crane-flies were kept in glass tubes for longevity trials, and these showed that on the average the males lived about 7 and the females 4–5 days. Mating and oviposition took place in these tubes. Twenty-seven females laid 5,408 eggs, averaging 200 each. About 45 per cent. of the eggs were laid on the day the female emerged, and 40 per cent. on the next day. It is believed that these figures are too low, as the regular observations stopped at 7 p.m. G.S.T., and it is suggested that 75 per cent. of the eggs are in reality laid by midnight on the actual day of emergence and 10 per cent. on the next day. The eggs were kept damp in solid watch-glasses, which were stood in water in culture dishes. It is shown that by the time the peak of crane-flies on the wing has been reached, the peak of eggs in the soil will already have been passed. Hatching took place 11–15 days after the emergence of the parent crane-fly, 2,498 larvae hatching from 5,408 eggs. The young larvae were kept in Petri dishes and fed on wheat rootlets, clover or chickweed leaves, pieces of cabbage leaves, potato or bran. By the time the 3rd instar was reached about 54 per cent. mortality had

occurred, chiefly owing to larvae escaping and cannibalism (576 survived out of 1,257). This stage was reached in roughly 14 days. The breeding potential was as follows: 51 per cent. of the nearly full-grown larvae gave rise to adults (this figure being low because of the number of larvae escaping); 75 per cent. of the available eggs were laid; 46 per cent. of the eggs laid hatched, and 46 per cent. of the larvae survived the first two instars. In other words, one female crane-fly laid 200 eggs, 92 larvae hatched and 44 survived the first two instars.

POTTER (C.). **A biological Study of the Fumigation of empty Warehouses with Hydrogen Cyanide and Ethylene Oxide.**—*Ann. appl. Biol.* **24** no. 2 pp. 415–441, 3 figs., 36 refs. Cambridge, May 1937.

An account is given of the methods of fumigation used against the hibernating larvae of *Plodia interpunctella*, Hb., and *Ephestia elutella*, Hb., present in the fabric of empty warehouses in London [R.A.E., A **22** 2, etc.].

The following is largely taken from the author's summary:—The first sheds were fumigated with Etox (ethylene oxide with 10 per cent. carbon dioxide), the rest with hydrogen cyanide. The factors involved in making a biological test of a fumigation are described. The effect of the fumigation was studied, first by its action on test insects placed in various positions in the warehouse and, secondly, by an examination of the warehouse to discover how the insects present had been affected. The actual measured concentrations of fumigants are given for the positions where the insects were examined. The results are given of a laboratory experiment on the action of hydrogen cyanide on the hibernating larvae of the above species which amplify those obtained in the warehouse. The results of other workers are summarised.

As it proved almost impossible to secure complete mortality with the methods described, a different technique was worked out which has been successful against such infestations and has already been discussed at some length [**24** 191].

PEMBERTON (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass. 1936* pp. 20–27. Honolulu, 1937.

An account is given of work carried out in Hawaii in the year 1935–36, mainly on pests of sugar-cane. Larvae and adults of *Anomala orientalis*, Waterh. [cf. R.A.E., A **24** 379] were present in very small numbers in fields formerly infested, but no injury to sugar-cane was reported during the year, and no migration beyond the known limits of distribution occurred. Inspection or hot-water treatment of cane shipped from infested territory to other parts of Hawaii is, however, rigidly maintained. The parasite, *Campsomeris marginella modesta*, Sm. (*Scolia manilae*, Ashm.), was still very abundant, and *Tiphia segregata*, Cwf., was active. None of the parasites imported in 1934 is known to have become established. Over 100 larvae of *Pyrophorus bellamyi*, Zwaluwenburg, were liberated during the year.

Serious damage by the cane borer, *Rhabdocnemis obscura*, Boisd., was prevented in most localities by the Tachinid, *Ceromasia sphenorophori*, Villen., though not where harvesting was delayed and dead and dying canes were allowed to lie about, as these formed excellent breeding

places out of reach of this parasite. Continued tests on hardness again indicated that canes as soft as or softer than P.O.J. 2878 may be expected to be susceptible to attack by the borer. Out of 18 promising seedlings, 15 varieties were found to be harder, and 8 were classified as commercially resistant. The only hybrid of *Saccharum robustum* included was among the hardest. In 2,500 tests, tasseled canes were found to be softer than canes of the same age that had not tasseled. Thorough burning-off of ratoon fields and clearing of unmillable canes immediately after harvest delays reinfestation.

Shipments of the toad, *Bufo marinus*, the population of which appears to have reached a stationary level, have been discontinued except in answer to special requests. It is known that it eats adults of *A. orientalis*. During July, measures had to be taken against a heavy infestation of asparagus by *Thrips tabaci*, Lind. For the control of armyworms on sugar-cane, a dust containing 5 per cent. Kayso [calcium caseinate], 15 per cent. white arsenic and 80 per cent. finely powdered raw rock-phosphate adhered better than mixtures previously used [21 16]. *Hercothrips femoralis*, Reut., which damaged sugar-cane in a greenhouse in Honolulu, had not previously been recorded on it in Hawaii, though since 1930 it has been known to occur on other greenhouse plants including pineapple, tomato and red beet. One of the parasites of the pepper [*Capsicum*] weevil [*Anthonomus eugenii*, Cano], a Pteromalid introduced in November 1934, is now definitely established and is contributing to its control on Oahu and Lanai.

O. H. Swezey, who is making an insect survey of the island of Guam on account of the danger of the introduction of pests from Guam into Hawaii in aeroplanes, reports the collection of many beneficial species. These include a Capsid [*Cyrtorhinus lividipennis*, Reut.], closely allied to *C. mundulus*, Bredd., taken on maize, where it was feeding on the eggs of the corn leafhopper [*Peregrinus maidis*, Ashm.].

WILLE (J. E.). El "Control Biológico" de ciertos insectos dañinos en el Perú. [The Biological Control of some Pests in Peru.]—*Bol. Direcc. Agric. Peru* 6 (1936) no. 22-23 pp. 159-163. Lima, 1937.

The history of the biological control of insect pests in Peru is reviewed, and notes are given on some instances of it. In 1936 the toad, *Bufo marinus*, was imported from Porto Rico against Lamellicorn larvae injuring sugar-cane; *Cryptolaemus montrouzieri*, Muls., was introduced from the United States against *Pseudococcus citri*, Risso, on *Citrus*, but has not yet become established, and *Metaphycus lounsburyi*, How., and *Scutellista cyanea*, Motsch, have been imported, also from the United States, against the olive scale, *Saissetia oleae*, Bern. Further consignments of these three parasites are awaited, as well as one of *Ascogaster carpopcapsae*, Vier., for use against *Cydia* (*Carpocapsa*) *pomonella*, L., on apple.

WILLE (J.). Plagas de insectos del aji. [Pests of Chilli Pepper.]—*Cartilla Direcc. Agric. Ganad., Minist. Fom. Peru* no. 29 pp. 1-5, 2 figs. Lima, April 1937.

Brief notes are given on the commoner insect pests of chillies [*Capsicum*] in Peru. The leaves are often attacked by various Aphids, which, however, are checked by Syrphids, Chrysopids, predacious bugs and the

Coccinellid, *Cyclonedaa* (*Neda*) *sanguinea*, L. Severe infestations may be controlled by either nicotine sulphate or kerosene-soap emulsion. The latter is also recommended against the larvae of *Aleurotrachelus trachoides*, Back, which attack the under-sides of the leaves. This Aleurodid produces two generations a month in spring. Noctuid larvae, usually those of *Heliothis armigera*, Hb. (*obsoleta*, F.) or of species of *Xylomyges*, attack the fruits, but may be controlled by a spray of lead arsenate and slaked lime. Two flies, *Euxesta annonae*, F., and *Lonchaeia* (*Carpolochaea*) *pendula*, Bezzi, are only rarely primary pests, as the females usually oviposit in fruits already attacked by fungi or Noctuid larvae.

SQUIRE (F. A.). **Observations on the pupal Diapause of the Orange Dog (*Papilio anchisiades* L.).**—*Trop. Agriculture* **14** no. 6 pp. 170–171, 3 figs., 4 refs. Trinidad, June 1937.

These observations on *Papilio anchisiades*, Esp., in British Guiana confirm previous conclusions [*R.A.E.*, A **25** 73].

FENNAH (R. G.). **Lepidopterous Pests of the Sour-sop in Trinidad.**
(1) *Cerconota (Stenoma) anonella* Sepp.—*Trop. Agriculture* **14** no. 6 pp. 175–178, 4 pls., 4 refs. Trinidad, June 1937.

An account is given of the bionomics and control of *Cerconota anonella*, Sepp, which attacks sour-sop (*Annona muricata*) in Trinidad, rarely leaving more than half the fruits on a tree unblemished. All stages of this moth are briefly described, and the nature of the injury is discussed. The female lays eggs singly on the surface of the fruit; although each fruit may carry over 12 eggs, 10 adults are the most that have been reared from one. In the laboratory, the maximum number of eggs laid by a female in three days was 14. One day after emergence, one female contained 264 eggs, only 20 of which were full-sized. The larvae hatched in 2–3 days and then bored into the fruit, where the larval period of 11–12 days was passed. Observations in the field appeared to indicate that fruits more than 6 inches long are not attacked; in the laboratory such fruits were only entered when previously punctured. Many larvae die before entering the fruit, but few afterwards. From a study of the head-capsules of the larvae, it appears that there are five ecdyses. The pupa is formed in the tunnel near an exit hole previously prepared by the mature larva, and the pupal stage lasts 11–12 days. The pre-oviposition period is 2 days. The life-cycle is usually completed while the fruit hangs on the tree. No parasites or other natural enemies of this pest have been observed.

The fruits are most susceptible to attack when between 1 and 6 inches long. The enclosure of each in a bag of cloth or waxed paper has been found to give complete protection from the pest if applied before the fruit is 2 inches long, though this procedure seems to increase the amount of fruit that drops. Control was also given by a spray of lead arsenate (2 per cent.) with casein, applied with a small sprayer or by dipping the fruit on the tree into a small vessel containing the mixture. Three applications should be given during the period of susceptibility. This method, however, does not protect the fruit from attack by the Eurytomid, *Bephrata maculicollis*, Cam. The Lycaenid, *Thecla ortygnus*, Cramer, also attacks the growing fruit.

BARTLETT (K. A.). **The Introduction and Colonization in Puerto Rico of beneficial Insects.**—*Agric. Notes Puerto Rico Exp. Sta.* no. 75, 8 pp. Mayaguez, P.R., May 1937.

DOHANIAN (S. M.). **The Search in the American Tropics for beneficial Insects for Introduction into Puerto Rico.**—*Op. cit.* no. 76, 7 pp. June 1937.

The first paper, which is the beginning of a series, is a discussion on biological control, with particular reference to Porto Rico. The second shortly describes the collecting or breeding of insect parasites and predators in Trinidad, Peru and British Guiana in 1935–36 and their introduction into Porto Rico for the control of *Diatraea saccharalis*, F., on sugar-cane, *Selenothrips (Heliothrips) rubrocinctus*, Giard, on cacao, the onion thrips, *Thrips tabaci*, Lind., and the coconut scale, *Aspidiotus destructor*, Sign. The numbers of each species shipped and of those surviving the journey are given.

SAINT VINCENT. **A Proclamation. The Plant Protection Ordinance, 1935.**—1 p. St. Vincent, 1937.

In virtue of the Plant Protection Ordinance no. 14 of 1935 [R.A.E., A 23 559] the importation into St. Vincent from Haiti, Santo Domingo, Cuba, Mexico, Central America and the South-eastern States of the United States of America of articles including any that have been declared by the Agricultural Authority to be infested or suspected of being infested by *Anthonomus grandis*, Boh., all malvaceous plant material, and all agricultural produce, is absolutely prohibited.

BOX (H. E.). **Sugar-cane Moth Borer (*Diatraea*) Investigations. No 3. Report on *Lixophaga* Campaign for 1936 and the Status of the Parasite in Antigua at the End of the Year.**—21 pp., 18 refs. Antigua, Colon. Developm. Fund, 1937.

Surveys in 1936 of the areas in Antigua in which *Lixophaga diatraeae*, Tns., was released against *Diatraea saccharalis*, F., on sugar-cane in 1932–33 [R.A.E., A 21 661; 23 448, etc.] showed that the parasite population had declined progressively since 1934 and that nodal infestation by *Diatraea* had increased to 12·1 per cent., which is thought to be normal. In May 1936, a fresh stock of the Tachinid was brought from St. Kitts, where in 1935 the average current parasitism for the whole island was 31·8 per cent. Breeding was carried out under improved laboratory conditions, and between June and November 6,115 of the resulting fertile females were distributed in 268 colonies. The successful establishment of many colonies is thought to have been due to abnormally wet weather when the distribution of the flies was at its height; few or no colonies were established in relatively high sections of the limestone region with moderate to low rainfall. It is thought that chances of success are not increased by using colonies of more than 20–25 fertile females, and liberations should not be made in ratoon fields unless these are heavily infested. *Lixophaga* populations are also influenced by the infestation of *Diatraea* by *Cordyceps barberi* [21 662]; the average mortality of the borer due to this fungus was 18·34 per cent. in November and December 1936, and in individual fields it varied from 0 to 51·0 per cent.; the lowest maximum (2·4 per cent.) occurred on a thin Indian cane which is, however, not usually heavily attacked by the borer. The best and most promising *Lixophaga*

colonies have become established on another variety, P.O.J. 2878 [24 462], with an unusually high borer population, which is only slightly infested by *Cordyceps*.

The reasons for the successful establishment of *Lixophaga* in St. Kitts are thought to be the constancy of the soil factor, high susceptibility to borer of the 2 dominant varieties of cane grown, the lower infestation by *Cordyceps* and the more even distribution of the host [cf. 23 345].

It is proposed that another parasite of *Diatraea*, the Dexiid, *Paratheresia claripalpis*, Wulp, should be introduced from Trinidad for large scale experimental work in 1938.

A classification of the estates in Antigua according to soil types, and statistical details of the survey are given in a series of appendices.

BIEBERDORF (G. A.). The Spring Emergence of the Codling Moth.—

Proc. Okla. Acad. Sci. **16** (1935) pp. 33–35. Norman, Okla., 1936. [Recd. July 1937.]

In November 1934, in order to watch the spring emergence of the adults of *Cydia (Carpocapsa) pomonella*, L., and thereby improve the timing of spray applications, several hundred larvae of the moth were collected and kept in small cages through the winter. They were then transferred to a large cage, which was placed in an apple orchard in Oklahoma under one of the trees. From 1st April, daily temperatures were taken and counts made of the moths that emerged. The first one appeared on 14th April (temperature 85°F.), but no more till 23rd (76°F.). After 25th April, they emerged in greater numbers, which were closely associated with the temperatures recorded, the latest date of emergence being 18th June. A table is given showing the daily emergence and daily maximum temperature from 14th April to 20th June 1935. There were 3 peaks of emergence, May 1st (82°F.), 8th (83°F.) and 27th (80°F.).

WORTHLEY (H. N.) & MARSTON, jr. (L. C.). Preparing chemically treated Bands for Codling Moth Control.—*Bull. Pa agric. Exp. Sta.* no. 330, 15 pp., 3 figs. State College, Pa, May 1936. [Recd. July 1937.]

Studies on chemically treated bands for the control of *Cydia (Carpocapsa) pomonella*, L., on apple were made in Pennsylvania in 1935 [cf. R.A.E., A **22** 397, etc.]. Experiments on the preparation of the bands were confined to treating 2 in. corrugated strawboard bands by cold dipping. Kraft-faced bands gave better control than jute-faced ones, but were less durable. Mixtures of 1·5, 2 and 2·5 lb. Cod-Ban (a factory-ground product containing 60 per cent. mineral oil and 40 per cent. crude beta-naphthol) with 1 U.S. pt. petrol (containing no tetra-ethyl lead) were compared. The three methods of dipping the rolled bands were complete immersion for 30 secs., immersing them upright to $\frac{3}{4}$ their width, once from each side, and double-dipping by repeating the second method after 30 mins. In the first series of tests of these methods, clogging of the tunnels was excessive owing to insufficient draining. In the second series, each band was allowed to drain until dripping almost ceased; it was then shaken sharply four times, turned over and left on wire netting to dry, during which process it was turned over at frequent intervals. The least uniform

results followed complete immersion, but kraft-bands treated with 2 : 1 mixture by this method gave satisfactory results. The 2·5 : 1 mixture produced the heaviest loads, but the number of clogged tunnels was large, and it was considered too thick. Double-dipping increased the lighter loads produced by the thinner mixtures without causing clogging and improved kill with the 1·5 : 1 mixture, for which it was essential, but not with the 2 : 1 mixture.

These bands, as well as two commercial brands made by the hot-dip method, were tested by fixing strips of treated band to half the tree-trunk and strips of untreated band to the remaining half, the treated band being on the west and east sides of alternate trees. The bands were applied from 14th to 20th June, before the mature larvae began to leave the fruit. During the season, they trapped 11,489 larvae on 240 trees. Of the 67 per cent. which were in the treated parts, 66 per cent. were dead and 1·2 per cent. had completed development. Of the 33 per cent. in the untreated bands, 3·3 per cent. were dead and 14·6 per cent. had completed their development. This represents a 92 per cent. control effected by treating the bands. In several cases, the cold-dipped bands were somewhat more effective than the commercial products, though the latter were quite satisfactory. The retention of the chemical coating in the bands treated by complete immersion was poor in comparison with the commercial bands and with those dipped by the second method, and more beta-naphthol was lost from them.

The question of cost is discussed, and it is concluded that banding is economically practicable as a supplementary measure to spraying. Recommendations for scraping and pruning the trees and for preparing, fixing and removing the bands are appended.

SHERMAN III (F.). **Chemically treated Codling Moth Bands.**—*Quart. Bull. Mich. agric. Exp. Sta.* **19** no. 4 pp. 222–227, 4 figs. East Lansing, Mich., May 1937.

The importance of chemically treated bands as a supplementary measure for controlling the codling moth [*Cydia pomonella*, L.] on apple in Michigan is emphasised, and directions are given for scraping the trees, and preparing the bands [R.A.E., A **24** 140] and applying them, with brief notes on proprietary treated bands and proprietary cold-dip mixtures.

FILINGER (G. A.). **Variations in the Effectiveness of chemically treated Codling Moth Bands.**—*Proc. Amer. Soc. hort. Sci.* **32** (1935) pp. 191–194. College Park, Md. [1936.] Recd. July 1937.]

Further information is given on the use in 1933–35 of corrugated paper bands impregnated with beta-naphthol dissolved in oil for the control of codling moth [*Cydia pomonella*, L.] on apple in Kansas [cf. R.A.E., A **25** 92]. The effectiveness of the bands varied considerably, the maximum percentage emergence of moths from larvae entering them in 1933, 1934 and 1935 being 2·5 (from bands left over the winter), 7·0 and 22·5 (from those examined in the autumn), respectively. During the hot summer of 1934, some mature larvae transformed into adults in 7 days instead of 14–20, and it is thought that shorter exposures lessen the effectiveness of the contact insecticide [cf. loc. cit.].

The percentage loss of beta-naphthol during the summer is tabulated. By 14th September the amount had decreased in every case to less than half, and in some cases to less than 10 per cent. With similar bands, the greater the load of beta-naphthol, the better was the control; thus in June 1935, with 2-inch bands carrying 3·6 and 7·1 oz. per 25 ft., the emergences were 3·3 and 0·43 per cent., respectively. Those from similarly treated 2-inch and 4-inch bands were 1·2 and 22·5 per cent., and, on analysis of both old and new 4-inch bands, it was found that the two outer 1-inch strips contained almost twice as much beta-naphthol as the central 2-inch strip; thus larvae spinning cocoons near the middle would be less likely to be killed than those near the edges.

During 1935, some 2-inch bands were treated with a mixture of beta-naphthol, oil and aluminium stearate, the proportion of beta-naphthol being rather less than in the ordinary 2-inch bands. They remained fairly sticky, and only 0·87 per cent. of the larvae entering them gave rise to adults. Beta-naphthol that becomes dry and crystalline is less effective.

Young or smooth-barked trees may be injured by bands heavily impregnated with beta-naphthol. Of the protective materials tested, waterglass, linseed oil and a water emulsion of asphalt gave the more promising results.

VINSON (C. G.). **Spray Residue Work in Missouri.**—*Bull. Mo. agric. Exp. Sta.* no. 382, 15 pp. Columbia, Mo., April 1937.

In Missouri in 1935, water alone at 78°F., in the wash section of an underbrush flood-type washer, reduced by as much as 50 per cent. the lead (and As_2O_3) content of the residue on apples that had been sprayed with lead arsenate when the original load did not exceed 0·050 grain lead per lb. fruit. The fruit was in contact with the water for 30 seconds. The lead residue was reduced from 0·080 gr. to below tolerance (0·018 gr.) by 1·2 per cent. hydrochloric acid at about 60°F. When oil had been used with each cover spray, the addition of 4 lb. Vatsol to 100 U.S. gals. did not suffice to reduce the lead content from 0·10 gr. to within tolerance limits at 65°F. with 30 secs. exposure. For fruit so sprayed it was necessary to heat the wash solution to 100–110°F. Where Kolofog [bentonite-sulphur] and oil had both been used, it was necessary to increase the time of exposure as well as to heat the solution containing Vatsol. The use of lime in sprays greatly facilitated the removal of residue even when Kolofog or oils had been used. Home-made flotation washers are satisfactory for removing light to medium residues. It was possible to reduce the arsenic content of the residue to, or nearly to, zero and yet leave an appreciable residue of lead. Zinc is definitely an interfering substance in the determination of lead by the diphenylthiocarbazone (dithizone) method.

BARBER (G. W.) & DICKE (F. F.). **The Effectiveness of Cultivation as a Control for the Corn Earworm.**—*Tech. Bull. U.S. Dep. Agric.* no. 561, 16 pp., 2 figs., 1 ref. Washington, D.C., April 1937.

Experiments were carried out with simulated and actual ploughing of a Piedmont red clay, a sandy loam and an artificial soil with a high humus content at Charlottesville, Virginia, and a fine sand soil at

Savannah, Georgia, during the period 1928-33, to determine its effect on the corn earworm, *Heliothis armigera*, Hb. (*obsoleta*, F.) emerging from hibernation. The larvae used in the experiments were the largest obtainable and were generally in the 5th or 6th instar. To reduce autumn moth emergence to a minimum, they were collected as late as possible in the season, during the second and third weeks of September at Charlottesville, and in the first week at Savannah. They were kept in two types of cages, the first consisting of a board frame 30 ins. square by 10 ins. deep, to which was hinged a frame lid 4 ins. deep, covered with 14-mesh wire screen; the cages were open at the bottom and hardware cloth set in the surrounding soil excluded moles. The second type, a screen-covered area, 10 by 20 feet, was used as a control. Ploughing was simulated by digging to a depth of about 8 ins. in the small cages; in the larger ones the ends were removed and the soil ploughed with an 8-inch-bottom plough. The larvae were kept isolated and completed their development on maize in the dough stage. A day or so before becoming full-grown they were placed on the soil with a supply of fresh food beneath an inverted box, so that they could dig into the soil. In the smaller cages 100 larvae were placed and in the larger 1,000, all those dying on the surface being replaced.

In no case did all the larvae give rise to moths, and natural mortality was more or less continuous from the time the larvae entered the soil in the autumn until emergence in the following summer. It was higher when larvae entering the ground and newly-formed pupae were subjected to a wet soil, but a soil saturated with water over a considerable period of time did not materially increase mortality after the pupae had hardened. Cages on uncultivated soil at Charlottesville were examined at regular intervals, and the percentages of living pupae recovered approximately 2, 7 and 8 months after the larvae had entered the soil averaged over 5 years, 30.5, 14.2 and 11.5 on red clay, 42.5, 12.3 and 10.7 on sandy loam and 12.4, 2.8 and 1.1 on soil with a high humus content, respectively. In experiments on this last soil nearly all the pupae were killed by the fungus, *Sorosporella uvella* [cf. R.A.E., A 8 169]; and over the 5-year period no moths emerged. At Charlottesville and Savannah, adults emerged 255-277 and 209-333 days after the larvae had entered the soil; the emergence period varied from 47 to 63 and from 89 to 124 days, and the emergence peaks occurred in late June and early July and in May and June, respectively.

The tunnels through which the moths escape and which end from $\frac{1}{4}$ to $\frac{1}{2}$ an inch below the surface of the soil may sometimes be found in good condition after over a year. Only one side of the pupa is in direct contact with the earth, the space between it and the walls of the base of the tunnel being sufficient for circulation of the air. Ploughing to a depth of about 6 inches dislodges the majority of pupae from their normal position and, with subsequent cultivation, destroys nearly all the tunnels. To determine the extent of moth emergence from such pupae, a series of 944 were placed at various depths in soil in the insectary in 3 positions, vertical with head down, vertical with head up, and horizontal. In moist sandy loam, receiving no moisture after the beginning of the experiment, no moths emerged from pupae placed vertically head downwards at a greater depth than 2 ins., but adults successfully emerged from pupae placed vertically head upwards at depths of

up to 10 ins. Of 35 individuals at 10 ins., 25 reached the surface, but 3 were crippled. Moths also emerged from pupae placed horizontally at a depth of 8 ins., but failed to do so from one of 10. In a second experiment, in which the conditions were similar except that the soil received moisture immediately after the pupae had been placed in it, moths emerged from pupae buried horizontally and vertically in an upright position, at depths of 5 and 6 ins., respectively. In the moistened soil many died while trying to emerge, this indicating that the effect was to pack the soil about the pupae. In similar experiments conducted out-of-doors in standard hibernation cages, moths emerged from pupae buried in all positions at depths of 1-4 ins., the total percentage of emergences being much lower than in the laboratory experiments, probably owing to intermittent rains and extremes of temperature.

For 5 years on red clay and sandy loam and for 2 years on the fine sand soil, the percentages of larvae that gave rise to moths in the small cages were 1·13, 0·3 and 7·8 respectively, when the soil was dug over in autumn, 9·1, 10·1 and 31·4, when it was left untreated, and 1·6, 0·7 and 13·5, when it was dug over in spring. Disking the sandy loam soil in the autumn reduced the percentage of emerging moths from 9·8 to 1·75 in the large cages. It is concluded that contact with the earth on all sides during hibernation, preventing air-circulation, is unfavourable to pupal survival, and that the natural packing of the soil during hibernation is unfavourable to emergence. Autumn and spring ploughing and autumn disk ing are, in this order, important factors in controlling the earworm, although none gives complete control.

LATTA (R.). The Rhododendron Whitefly and its Control.—*Circ. U.S. Dep. Agric.* no. 429, 8 pp., 4 pls., 3 figs., 2 refs. Washington, D.C., April 1937.

Most of this information on the bionomics and control of *Dialeurodes chittendeni*, Laing, on *Rhododendron* in the United States has already been noticed [R.A.E., A 25 242]. All stages of the insect are briefly described, and its distribution is discussed. A list is given of different varieties infested, with notes on their susceptibility, which appears to depend on physical differences in the leaf surfaces.

ELMORE (J. C.). The Tomato Pinworm.—*Circ. U.S. Dep. Agric.* no. 440, 8 pp., 4 figs., 3 refs. Washington, D.C., May 1937.

Biological studies of *Phthorimaea (Gnorimoschema) lycopersicella*, Busck, on tomato in California are compared with similar investigations in Pennsylvania [cf. R.A.E., A 24 525]. In southern California, in 1936, the average infestation was 28 per cent. with a maximum of 99 per cent. of the fruit in the late fields. *Solanum umbelliferum* is given as an additional food-plant. Many of the larvae feed on the tomato leaves, and those that feed on the calyx lobes or the adjacent leaves enter the fruit. Many feed only on the core, which may be removed at the cannery, but they may cause decay and, if numerous, their presence may cause the rejection of the manufactured products.

The duration of the immature stages at temperatures of 50-55 and 76-80°F. was 20 and 5, 41 and 10, and 39 and 11 days for the egg, larval, and prepupal and pupal periods, and the males and females

lived for 21 and 10, and 25 and 7 days, respectively. Thus the life-cycle may be completed in 26–34 days in the summer, and there may be 7 generations annually on field-grown tomatoes. C. A. Thomas reports that during the mild winter of 1936–37 the pinworm survived field conditions in Pennsylvania [cf. 25 292]. In southern California the insect appears able to lay eggs and develop during any winter when temperatures permit the survival and growth of tomato plants. In March 1937, large numbers survived in one locality where the longest period of low temperatures on record had occurred during January, including a minimum of 22°F. and a total of 17 nights when the temperature fell below freezing point. In general, however, development is greatly retarded by winter temperatures and may cease completely except for the survival of pupae, in or on the soil, and of moths in protected situations.

In addition to the control measures already noticed [24 525], it is recommended that, after picking the fruit, the fields should be disked to cut up the remaining green plants, which should then be ploughed in. Alternatively, they should be cut and burnt, together with any other food-plants growing nearby.

KNOWLTON (G. F.) & SORENSEN (C. J.). *The Pea Aphid.—Leaf.* Utah agric. Exp. Sta. no. 76, 4 pp., 1 fig. Logan, Utah, April 1937.

During 1936, *Macrosiphum onobrychis*, Boy. (*pisii*, Kalt.) caused serious injury to peas for canning throughout Utah and to lucerne in scattered localities. It also attacked garden peas and sweet peas [*Lathyrus odoratus*], and, less severely, clover and sweet clover [*Melilotus*]. In Utah, most wingless viviparous females [R.A.E., A 20 680] begin to produce young from $\frac{1}{2}$ to 3 days after reaching maturity, the nymphs having moulted four times. Each female is capable of producing 2–15 young daily, with a total of 50–175. Both winged and wingless females occur in all summer generations, and wingless, oviparous females and winged or wingless males in the last autumn generation, except in the warmer southern part of the State where viviparous females sometimes survive and reproduce throughout the winter.

Recommended methods of control on peas for canning are prompt spraying with cubé or derris (4 per cent. rotenone) at 3 lb. to 100 U.S. gals. water with a power sprayer at a pressure of at least 300 lb., preferably on a quiet, warm day, and dusting with a mixture of 50 lb. hydrated lime, 5 lb. monohydrated copper sulphate and 2 U.S. qts. 40 per cent. nicotine sulphate at the rate of 50 lb. per acre. For control on lucerne, pasturing, cultural methods (when the lucerne is not infected with bacterial wilt), broadcasting of granular calcium cyanide, irrigation and burning over [20 409; 22 106, etc.], and mowing the crop and removing the hay quickly to deprive the Aphids of shade, are advised. These measures will also control *Aphis medicaginis*, Koch, which infests leguminous plants, including lucerne and various clovers.

SCHWARTZE (C. D.) & HUBER (G. A.). *Aphis Resistance in breeding Mosaic-escaping Red Raspberries.—Science* 86 no. 2224 pp. 158–159, 2 refs. New York, 13th August 1937.

Previous investigation [R.A.E., A 15 598] indicated that certain red raspberry varieties, which are no longer available or are undesirable,

are either immune from red raspberry mosaic or non-infectible by its common vectors. In experiments in a district of western Washington, the authors found that the Lloyd George variety completely resisted mosaic infection by the Aphid vector, *Amphorophora rubi*, Kalt., and that it transmitted this characteristic when hybridised with a susceptible variety. Varieties grown in the field differed greatly in their susceptibility to the Aphid and the spread of mosaic appeared to be directly proportional to the relative Aphid populations. The behaviour of *A. rubi* when confined on Lloyd George plants under cages indicated that it probably finds them unsuitable for food rather than actually repellent.

BAERG (W. J.), ISELY (D.) & SCHWARDT (H. H.). Entomology.—
Bull. Arkansas agric. Exp. Sta. no. 337 (Rep. 1935–36) pp. 42–46.
 Fayetteville, Ark., December 1936. [Recd. July 1937.]

This report deals with investigations on insect pests in Arkansas for the year ending 30th June 1936. Damage to maize by *Eutheola rugiceps*, Lec., was more severe and occurred over a wider area than has been previously recorded. The beetles deposit their eggs on land subject to floods, especially if Johnson grass [*Sorghum* sp.] and other weeds and grasses grow up. Poorly drained corners of fields left in Bermuda grass [*Cynodon dactylon*] and other species also act as sources of infestation. Hand-picking appears to be the only method of control.

In laboratory experiments on *Tyloderma fragariae*, Riley, on strawberries, dusts of sodium fluosilicate or lead arsenate, both with equal quantities of hydrated lime as carrier; derris containing 5 per cent. rotenone; and undiluted calcium arsenate gave 7, 35, 58 and 58 per cent. control, respectively. *T. foveolata*, Say, usually found on weeds and evening primrose [*Oenothera*] is also thought to be attacking strawberries in Arkansas [5 463].

The striped cucumber beetle [*Diabrotica melanocephala*, F.] on cucurbits was controlled by dusting with equal parts of sodium fluosilicate and talc. Hydrated lime may be substituted for talc, though the mixture may cause foliage injury. Barium fluosilicate, which is now marketed in a form containing 20 per cent. carrier, was equally effective. Both dusts should be applied when the beetles are actively feeding; this may be early in the morning in midsummer, as they tend to hide during the heat of the day.

WATSON (J. R.) & others. Entomology.—*Rep. Florida agric. Exp. Sta.* 1935–36 pp. 64–69. Gainesville, Fla. [1937.]

Experiments in 1935–36 on *Anthonomus eugenii*, Cano, on pepper [*Capsicum*] in Florida [cf. R.A.E., A 25 87] showed that effective control could be obtained by field sanitation and the destruction of infested plants at the end of the picking season in June or July, and also by picking up all dropped fruit from early May onwards and dusting the plants at intervals with calcium arsenate. The incubation, larval, pupal and pre-oviposition periods lasted for about 2·5–3, 7–8, 4–5 and 4 days, respectively. Although the weevils were able to survive for 13 days on nightshade (*Solanum* sp.) or egg-plant [*S. melongena*], these are not important summer food-plants.

The cold winter, unusually dry at first and very wet in February, proved most unfavourable for Aphids and for the Florida flower

thrips, *Frankliniella cephalica bispinosa*, Morg., which was abnormally scarce. The Coccinellid, *Leis dimidiata*, F., var. *quinquedecimspilota*, Hope, has continued to spread and was most abundant in the outlying districts of its range. *Nezara viridula*, L., *Leptoglossus phyllopus*, L., and *Acanthocephala* sp., all on thistle, occurred in smaller numbers than usual, owing to the severe winter and the increase of parasitism by *Trichopoda pennipes*, F. Observations on the shedding of pecan nuts showed that average losses of 7·1 and 5·9 per cent. were caused by the shuckworm [*Enarmonia caryana*, Fitch] and the nut case-bearer [*Acrobasis caryaef*, Grote] respectively.

BEDARD (W. D.). **Biology and Control of the Douglas-fir Beetle *Dendroctonus pseudotsugae* Hopkins (Coleoptera-Scolytidae) with Notes on associated Insects.**—*Res. Stud. St. Coll. Wash.* **5** no. 2 pp. 103–105. Pullman, Wash., June 1937.

Since 1900, *Dendroctonus pseudotsugae*, Hopkins, has been a serious pest of Douglas fir [*Pseudotsuga taxifolia*] in the western United States and in Canada, and at least 90 million board feet of mature timber are now being destroyed by this beetle every year.

The results of the author's investigations, begun in 1930, into its life-history are here summarised. The female tunnels an unbranched gallery in the tree parallel with the grain of the wood. The male follows and, after pairing, either seeks a fresh mate or remains to assist in disposal of the borings. Eggs are deposited in groups of 2–13 along the sides of the gallery, held in position by frass. Under field conditions these hatch in 15 days, and the larvae begin at once to feed, excavating galleries at right angles to the egg gallery. There are 5 larval instars, the approximate duration of each being 6, 13, 16, 16 and 17 days, respectively. The pupal stage lasts 8 days, and the new adults feed for a considerable time before emerging. In the area studied there is only one generation a year, but in specially favourable seasons there may be a partial second one. In addition, each female produces 2 broods.

The Braconid, *Coeloides brunneri*, Vier., is the most important parasite, its life-history synchronising with that of its host [R.A.E., A **22** 97]. Other parasites are the Pteromalids, *Cecidostiba dendroctoni*, Ashm., and *Rhoptrocerus (Pachyceras) eccoptogastri*, Ratz. The most important predators are the mite, *Seius safroi*, Ewing, which feeds on the eggs, the Clerids, *Thanasimus dubius*, F., and *Enoclerus sphaegeus*, F., and the Diptera, *Medeterus aldrichi*, Wheeler, and *Lonchaea corticis*, Taylor. Others of less importance are the Clerid, *T. nigriventris*, Lec. (*E. lecontei*, Wolc.), the Trogositid, *Temnochila virescens*, F., and the fly, *Xylophagus abdominalis*, Lw.

MCGREGOR (E. A.). **Report on certain Dusts tested against Citrus Thrips on Oranges.**—*Calif. Citrogr.* **21** no. 11 p. 436. (Abstr. in *Exp. Sta. Rec.* **76** no. 6 p. 827. Washington, D.C., June 1937.)

Experiments on the control of the citrus thrips [*Scirtothrips citri*, Moult.] carried out in California in 1934–35 showed that the addition of zinc compounds did not reduce the effectiveness of sulphur dusts against it. On the average, only 4·8 per cent. of the fruit from plots receiving these mixed dusts was injured. A dust containing 0·19 per cent. pyrethrins and 44·1 per cent. sulphur reduced the damage by

95 per cent., and one containing 0·5 per cent. rotenone (as derris dust) and 50 per cent. sulphur by 96 per cent. This protection was largely attributable to the sulphur dust in the mixtures, as powdered derris or pyrethrum with talc gave unsatisfactory results. Barium fluosilicate without sulphur was of little value, but when it was combined with 70 per cent. of sulphur, the mixture gave a marked reduction in the damage.

GUY (H. G.). Investigation of Organic Compounds as Insecticides.—
Bull. Del. agric. Exp. Sta. no. 206, 60 pp., 10 figs., 14 refs. Newark, Del., February 1937.

A progress report is given of investigations started in 1933 with the object of finding an effective substitute for lead arsenate that would be non-toxic to man and higher animals. Over 800 organic compounds have been tested as stomach poisons. Preliminary investigations were carried out with *Epilachna varivestis*, Muls. (*corrupta*, Muls.), on beans and *Leptinotarsa decemlineata*, Say, on potato as test insects, and the most toxic compounds so selected were employed against the larvae of *Cydia (Carpocapsa) pomonella*, L., on apples, in comparison with lead arsenate; supplementary tests were carried out on *Cydia (Grapholitha) molesta*, Busck. From 1935, *Popillia japonica*, Newm., was also employed as a test insect. In the initial test each compound was diluted as little as possible, and those that were toxic at this high concentration were diluted and re-tested until a concentration had been reached at which lead arsenate would be ineffective. Limited tests of such compounds were then made in the field to determine the tolerance of foliage to the new insecticides; and finally they were tested under the standard procedure for field experiments, with frequent repetitions, uniform coverage and comparison with standard treatments.

The following is substantially the author's summary : In laboratory tests, representatives of five different chemical groups, *viz.*, phosphoniums, co-ordinated chromium salts, thiazines, thiuram sulphides and thiocarbamates, approached the efficiency of lead arsenate in insect control without severely injuring plant foliage. However, under field conditions in Delaware only the thiuram sulphides have been shown to give excellent control, the thiocarbamates and phosphoniums not having been tested. Modifications of the other compounds, in particular the thiazines, may still be of commercial value as insecticides against specific insects on certain crops.

Methyl triphenyl phosphonium chloride and methyl triphenyl phosphonium iodide were the most effective members of the phosphonium group, but were uneconomic and therefore not tested extensively. Piperidinium tetra-thiocyanato-diammino-chromium was the most toxic of the co-ordinated chromium salts tested. In spite of attempts to stabilise it, however, sunlight and high temperature caused it to disintegrate, and the products injured the foliage, but were not toxic to insects. The most important result of the investigation into the thiazine group has been the development and practical application of thiadiphenylamine, the poor wetting properties and instability of which may be overcome by the addition of suitable wetting agents, stickers and stabilisers. The thiuram sulphides repelled chewing insects [*R.A.E.*, A **24** 546], tetra-methyl thiuram monosulphide and tetra-methyl thiuram bisulphide more effectively

than either lead arsenate or hydrated lime, both in the laboratory and in the field [25 424]. They protect foliage from the adult Japanese beetle without leaving a conspicuous spray residue. The thiocarbamates, which are still in the preliminary stages of investigation, also repel chewing insects, but not so effectively as the best of the thiram sulphides.

FREITAG (J. H.) & SEVERIN (H. H. P.). **Ornamental flowering Plants experimentally infected with Curly Top.**—*Hilgardia* **10** no. 9 pp. 263-302, 4 pls., 36 refs. Berkeley, Calif., November 1936. [Recd. 1937.]

Curly-top of beet was transmitted by means of *Eutettix tenellus*, Baker, to 92 species of ornamental flowering plants belonging to 33 families. The life-cycle of the leaf-hopper was completed on 65 species belonging to 23 families. The symptoms observed on the individual species are described and, in some cases, illustrated.

FREITAG (J. H.). **Negative Evidence on Multiplication of Curly-top Virus in the Beet Leafhopper, Eutettix tenellus.**—*Hilgardia* **10** no. 9 pp. 305-342, 10 figs., 27 refs. Berkeley, Calif., November 1936. [Recd. 1937.]

In the course of investigations, no evidence was found to support the theory that curly-top virus multiplies in *Eutettix tenellus*, Baker. Insects that had fed for only a short period of time on a curly-top beet were capable of producing an average of 3·4 per cent. of infections when transferred daily to successive healthy beets during adult life, while insects fed for long periods caused an average of 15·6 infections.

HILDEBRAND (E. M.). **Infectivity of the Fire-blight Organism.**—*Phytopathology* **27** no. 8 pp. 850-852, 5 refs. Lancaster, Pa., August 1937.

Although relatively few bacteria of *Bacillus amylovorus* (fire blight) carried by bees into bee-hives ever get out again, on account of the treatment the nectar receives from the bees, the potentiality of dissemination by contaminated bees in their visits to fruit blossoms is enormous [R.A.E., A **24** 617]. Experiments were carried out to determine the minimum number of bacteria required to produce the disease. It is concluded that the inoculum from a single active fire blight canker might result in a severe epidemic of blossom blight in an orchard. One bee picking up contaminated nectar may easily infest flowers in ten other trees on one trip alone. How long bacteria from a given flower remain on a bee is not known, but bees feeding on infected food are still contaminated about a day afterward.

FERRIS (G. F.). **Contributions to the Knowledge of the Coccoidea (Homoptera) V.**—*Microentomology* **2** pt. 2 pp. 47-101, 43 figs. Stanford Univ., Calif., June 1937.

In this contribution, which is one of a series [*cf. R.A.E., A **24** 565*], 42 genotypes of Diaspine Coccids are listed and figured, completing a total of 139 genotypes so treated. Notes are given on the morphological distinctions between the tribes ASPIDIOTINI and DIASPIDINI, and on the status of the genera.

REED (W. D.) & LIVINGSTONE (E. M.). **Biology of the Tobacco Moth and its Control in closed Storage.**—*Circ. U.S. Dep. Agric.* no. 422, 38 pp., 22 figs., 22 refs. Washington, D.C., March 1937. [Recd. July 1937.]

The history and distribution of *Ephestia elutella*, Hb., are reviewed from the literature, and the injury it does to tobacco is described [*R.A.E.*, A 19 590]. Notes are given on the appearance and behaviour of all stages of the insect, on which observations were made in Virginia from 1931 to 1934 [*cf.* 21 457]. The larvae that passed the winter were one-fourth to full grown. Those that were full-fed hibernated in sheltered places about the building, the others in the tobacco. A temperature of 28°F. in the tobacco and 9°F. in the warehouse did not appear to reduce materially the larval population. Pupation began in March. The earliest adult emergence was on 24th April in 1932. In the laboratory, emergence of the overwintered generation lasted from 21st April to 15th July in 1932 and from 14th April to 9th July in 1933, the peak occurring on 15th and 12th May, respectively. In the warehouse, the peak was about 10 days later. There were two complete generations in a year. A few larvae of the first generation, half those of the second and all of the third overwintered. In 1933, peak emergence of first- and second-generation moths fell on 22nd July and 18th September, respectively. The longest time that an adult that emerged in the spring of 1933 had required to complete development was 380 days. In the laboratory studies, the greatest number of eggs obtained from one female was 260, and the longest time any one adult lived was 25 days. The average length of adult life was greatest (9.7 days) in the case of females that emerged between 12th and 19th May, when the average temperature was 70°F. The higher temperatures of 1933 did not appear to affect oviposition or longevity, but they hastened larval growth, so that 84 second-generation larvae completed development as against 5 in 1932, and second- and third-generation eggs appeared 25 and 49 days earlier, respectively, than in 1932. In 1932 and 1933, the incubation periods for first-generation eggs were 4–15 and 4–12 days, and for second-generation eggs 4–13 and 3–9 days, respectively. However, the average incubation periods for eggs laid in corresponding generations, excluding eggs laid by females emerging in October 1932, were approximately the same. No females emerged in 1933 after 26th August. The length of the larval stage in the first generation was 39–128 days in 1932 and 29–77 in 1933. The average length for second-generation larvae was also slightly shorter in 1933. However, the variation in the rate of growth of larvae cannot be satisfactorily attributed to temperature and quality of food alone. The duration of the pupal period was 5–25 days in 1932, and 8–15 in 1933. Development from egg to adult in the first generation took 58–152 days in 1932 and 46–123 in 1933. The life-cycle in warehouses in Virginia and North Carolina was approximately the same as in the laboratory.

The natural enemies [25 185] include *Microbracon hebetor*, Say, which was reared in the laboratory at a temperature of 65–85°F. The egg, larval, and pupal stages averaged 2, 3.4 and 5.2 days. Individual females laid 96–517 eggs, the average for 14 females being 323 eggs each.

In 1932, warehouses that had been carefully sealed were effectively fumigated at atmospheric pressure with 10 oz. hydrocyanic acid gas

per 1,000 cu. ft. and an exposure of 72 hours on 1st and 28th June, 3rd August and 8th September at an average total cost of about 2s. 6d. per 1,000 cu. ft. The average catch of moths on each of the adhesive light traps, one of which was used to every 97,000 cu. ft., in the weeks preceding these dates was 270·7, 5·4, 22·5 and 19·2. It is probable that infestation after 1st June was not of economic importance and that the second fumigation could have been omitted. The temperature of the stored tobacco should be 70°F. or above, and as the fumigant rarely penetrates more than 3 ins. into the tobacco, fumigations should be carried out when an average of 30 adults per trap is caught in a week. All eggs, larvae, pupae and adults that are near the surface of the tobacco are killed.

Service and Regulatory Announcements January-March 1937.—S.R.A., B.E.P.Q. no. 130 pp. 1-87, 1 map. Washington, D.C., U.S. Dep. Agric., June 1937.

The 12th revision of Quarantine no. 48 against *Popillia japonica*, Newm., in the United States, and the rules and regulations (15th revision) supplemental to it, both effective from 1st March 1937, are given in full; changes include the addition of further infested territory in the eastern states to the regulated areas. Potatoes may now be imported into the United States from Latvia, which has been shown to be free from diseases and pests new to, or not widely prevalent in, the United States.

In a note on fruit-flies in Ecuador, J. E. Wille states that 22 *Anastrepha striata*, Schin., 15 *A. distans*, Hend., and 4 *A. leptozona*, Hend., were reared from larvae found in guavas (*Psidium guayava*). Adults of *A. distans* were also taken from oranges, sugar-cane and *Eugenia* sp., and of *A. leptozona* from fruit and foliage of guavas. Larvae and puparia of *Anastrepha* spp. also occurred in *Inga* pods, grapefruit and apples. Most of the infestations occurred in the fluvial regions round Guayaquil. Plant-quarantine restrictions issued by British India, Mauritius, Gambia, the Union of Soviet Socialist Republics, Argentina, Hungary, Ceylon, Rumania and the Netherlands Indies are summarised, and amendments are noticed to restrictions issued by Peru, Czechoslovakia, Luxembourg, Germany, Great Britain, and Rumania subsequent to summaries already published.

List of Intercepted Plant Pests, 1936.—S.R.A., B.E.P.Q. 83 pp. Washington, D.C., U.S. Dep. Agric., June 1937.

This list of pests recorded from 1st July 1935 to 30th June 1936 as intercepted with plants and plant products entering United States territory is based on data relating to pests for which determinations were received and indexed during the fiscal year. It includes pests on products that have been imported, offered for but refused entry, held as ships' stores and hence not imported through customs, or offered for entry for immediate export or for immediate transportation and exportation in bond, as well as those in domestic shipments reaching the mainland from Hawaii and Porto Rico. The increase in the number of interceptions during the year necessitated the omission of thousands of records of partially determined insects from the detailed list in this paper, many of which may be more important than some of the items included. These interceptions are summarised under the heading of Incompletely Determined Pests. A few unnamed new

species and partially determined insects new to the records and believed to be important have been included. More or less cosmopolitan pests are listed in short paragraphs under the heading Common Pests Intercepted, and others not so widely distributed are included in these paragraphs whenever ample records of their interceptions have been published.

HARRIES (F. H.). Some Effects of Temperature on the Development and Oviposition of *Microbracon hebetor* (Say).—Ohio J. Sci. 37 no. 3 pp. 165–171, 2 figs., 10 refs. Columbus, Ohio, May 1937.

Preliminary observations were made in Ohio in 1931 on the effect of temperature on the life-history of *Microbracon hebetor*, Say, as a parasite of *Ephestia kuehniella*, Zell. [cf. R.A.E., A 21 667]. Relative humidity was maintained near 73·0 per cent. Two well-developed larvae of *E. kuehniella* were supplied as hosts to each of the female parasites, which were kept singly in cages. Fertile females, reared at 26–28°C. [78·8–82·4°F.], were used in oviposition studies.

The duration of the immature stages in different individuals varied from 8 days at 32°C. [89·6°F.] to 39 days at 16°C. [60·8°F.]. The egg and larval stages combined occupied about 30 per cent. of the period from oviposition to adult emergence. Between 20° [68°F.] and 32°C., the rate of development appeared to have a linear correlation with temperature, although the regression line was slightly curved. At 16°C., a marked deviation occurred, and a few specimens were reared at 12°C. [53·6°F.], which is below the minimum effective temperature shown by the linear relationship. Effective temperatures, as indicated by the regression line are those above 12·7°C. [54·86°F.], and the value of the thermal constant for development is 154 day-degrees C. [277·2 F.].

The maximum number of eggs laid by one female was 312; the average laid by 53 individuals at 26–28°C. was between 100 and 200. Eggs were laid regularly between 14°C [57·2°F.] and 36°C. [96·8°F.], the optimum being 26°C. Oviposition usually began 1–2 days after emergence and continued until death. Fertilisation had no marked effect on oviposition, but the progeny of unfertilised females consisted entirely of males. Mean oviposition rates did not indicate a thermal constant, but showed a sigmoid relationship between 16° and 28°C. with only a slight difference in the rate of egg-laying between 28 and 32°C. The temperature characteristic for oviposition between 16° and 26°C. has a least squares value of 21,400.

Entomology and Zoology.—Rep. S. Carolina Exp. Sta. 49 (1935–36) pp. 39–50. Clemson Coll., S.C., December 1936. [Recd. July 1937.]

As a result of abnormal weather conditions in South Carolina during 1936, insect pests usually of minor importance caused some damage to crops. F. Sherman and J. N. Todd report that infestation of beans by *Epilachna varivestis*, Muls., was not severe in spite of high emergence records. Control methods recommended include the use of sprays containing 1½ lb. 5 per cent. rotenone or 2½ lb. 4 per cent. rotenone (from powdered derris or cubé [*Lonchocarpus*]) in 50 U.S. gals. water, applied at the rate of 100–150 U.S. gals. per acre; dusts containing 15 lb. of 5 or 18½ lb. of 4 per cent. rotenone made up to 100 lb. with

talc or inert clay, applied at the rate of 20–25 lb. per acre ; and magnesium arsenate (2 lb. in 50 U.S. gals. water). Insecticides should be applied when injury first becomes noticeable and thereafter at intervals of 7–10 days as long as necessary.

O. L. Cartwright reports that examination of peaches at 4 localities showed that only 1 per cent. of the fruit was injured by the oriental fruit moth [*Cydia molesta*, Busck]. *Macrocentrus ancylivorus*, Rohw., and *M. delicatus*, Cress., appear to be well established as parasites of it [cf. R.A.E., A 24 805], and 12 other parasites were also recorded. Results of 4 years' experiments on the control of the southern corn stalk borer [*Diatraea cramboides*, Grote] on maize show that the best time to plant is in the first half of May, only 0·3–5 per cent. infestation having been recorded from maize planted then. Analysis by means of bait traps and adhesive screens of the movements of the rice weevil [*Calandra oryzae*, L.] on maize gave no apparent cause of the distribution and variation of infestation in the ears from 10 to 62 per cent. In one locality, 96·9 per cent. of the ears were attacked by the corn earworm [*Heliothis armigera*, Hb.], 91·6 per cent. by the pink cornworm [*Pyroderces rileyi*, Wlsm.], 36·1 per cent. by the rice weevil, 24·4 per cent. by the angoumois grain moth [*Sitotroga cerealella*, Ol.] and 63·7 per cent. by flour beetles [*Tribolium* spp.]. Data indicated that severe infestation is correlated with short length of the shuck over the tip of the ear. Complete control of the rice weevil on maize in cloth sacks and tight containers was obtained by dusting sulphur at the rate of 2 oz. per bushel [cf. loc. cit.] ; after 3 years, one treated sack was protected while a control sack was completely destroyed.

J. G. Watts observed that in 1936, *Sericothrips variabilis*, Beach, constituted about 75 per cent. of all thrips on young cotton [cf. 24 783], and was more abundant than usual on other plants. By means of marking experiments, it was shown that stalks severely injured by thrips produced fewer blooms and bolls than uninjured stalks, and were 10 days later in starting to bloom, so that more of the crop was heavily attacked by the boll weevil [*Anthonomus grandis*, Boh.]. Out of 9 combinations of insecticides tested for the control of thrips on cotton, a dust of 10 per cent. Paris green and 90 per cent. dusting sulphur gave the greatest reduction in population and the lowest percentage of injured stalks ; it did not injure the plants. The resistance of different varieties of cotton to this insect as measured by the percentage of injured stalks is shown in a table, and varied by 13·86 per cent. The cotton flea-hopper [*Psallus seriatus*, Reut.] was abundant during the season, and experiments showed that the addition of Paris green to the standard dusting sulphur (which is applied at the rate of 15 lb. per acre) increased the killing power considerably. A dust of calcium arsenate and Paris green also gave better results ; it was more expensive, but would also control the boll weevil.

STIRRETT (G. M.), BEAL (G.) & TIMONIN (M.). **A Field Experiment on the Control of the European Corn Borer**, *Pyrausta nubilalis* Hubn., by *Beauveria bassiana* Vuill.—*Sci. Agric.* 17 no. 9 pp. 587–591, 6 refs. Ottawa, May 1937.

The field tests described were carried out to determine the value of *Beauveria bassiana* for the control of natural infestations of *Pyrausta*

nubilalis, Hb., on maize in Ontario [R.A.E., A 23 175]. The inoculum for field use was made by mixing the spores with flour at the rate of 40 gm. to 16 lb. The spores were applied at the rate of 40 gm. per acre, and there were 4 series of plots, the first being untreated controls. The inoculum was applied to the 3rd, 2nd and 4th series on 8th July, 19th July, and both dates, respectively. These dates marked the beginning and height of the oviposition period, and the maize came into tassel between them. The inoculum was dusted with great care from a muslin bag into the throat of the maize plants, and at the second application new growth received special attention. Counts of the borers were made on 18th–21st August, before the great autumnal migration and the resulting reduction of the population, and again on 19th–22nd October; with the 2nd, 3rd and 4th treatments infestation was reduced by — 3, 33 and 22 at the 1st count and 21, 63 and 63 per cent. at the second count. The negative reduction was due to a chance excess of borers in the treated plots. At the time of the second count many larvae were dying or freshly dead, and a further reduction of the population was expected, but a third count was not made. The timing of the treatment is therefore concluded to be of the greatest importance.

SQUIRE (F. A.). **Nocturnal Habits of *Platyedra gossypiella* Saunders.**—
Nature 140 no. 3532 pp. 69–70, 2 figs., 3 refs. London, 10th July
 1937.

Records are given from the literature showing that in Egypt *Platyedra gossypiella*, Saund., is attracted to light [R.A.E., A 9 73], whereas in Hawaii it is believed to avoid it. Observations in St. Vincent, British West Indies, showed that there the moths are attracted from 8 p.m. to 4 a.m., but are concealed by 5 a.m., although it is still dark. Attraction to light was strongest during the mating period, and long- and short-cycle moths were equally phototropic.

Pairing took place 1–5 days after emergence and generally occurred in the last 2 hours of the active nightly period. The pre-oviposition period lasted about 3 days. Oviposition and feeding took place at any hour of the night.

LÓPEZ CRISTÓBAL (U.). **Un nuevo enemigo de la agricultura.** [A new Pest of Agriculture.]—*Bol. Lab. Zool. agric. Fac. Agron. La Plata* no. 2, 4 pp. multigraph. La Plata, 18th June 1937.

In June 1937, samples of wheat examined in La Plata were found to be infested by *Toxoptera graminum*, Rond. A brief account from the literature is given of the biology of this Aphid in the United States. A Braconid, *Aphidius platensis*, Brèthes, was observed parasitising it, and its other natural enemies included Dipterous larvae and Chalcidoids. If attack by apterous females of *T. graminum* occurs in patches, the plants should be cut and burned or sprayed with kerosene emulsion. For experimental and seed plots a spray containing 1 per mille each of nicotine sulphate and yellow soap is advocated. If the attack is by alate forms, the whole field should be ploughed under and re-sown with maize.

PORTER (C. E.). **Notas breves de entomología agrícola.**—*Rev. chil. Hist. nat.* **40** pp. 426–429. Santiago, Chile, 1936. [Recd. July 1937.]

These records of insects in Chile include *Dermestes vulpinus*, F., in corks; the Cerambycid, *Grammicosum signaticolle*, Blanch., boring in *Robinia pseudacacia*, and also found in hawthorn; and the Coreid, *Leptoglossus chilensis*, Spin., previously recorded from thistle and recently observed in abundance on peaches.

MCDONALD (J.). Ed. **Coffee in Kenya.**—Med. 8vo, vi + 210 pp., 28 pls., 2 maps, 1 loose transparency, text ill. Nairobi, Govt Printer, 1937. Price 5s.

This practical work on coffee-growing in Kenya, includes a section on "Insect Pests of Coffee" (pp. 112–147) by F. B. Notley. It comprises a key by which the more important pests may be identified by the damage they cause, popular descriptions of the pests arranged under orders, and formulae for insecticides.

FAURE (Jacobus C.). **Some Recent Advances in Research on Locust Problems.**—*S. Afr. J. Sci.* **33** pp. 797–811, 5 figs., 8 refs. Johannesburg, March 1937.

After a review of recent literature on the phase and the genotypic variations in Acrididae [*cf. R.A.E.*, A **20** 671; **24** 110], the outbreak centres of *Locustana pardalina*, Wlk., and *Nomadacris septemfasciata*, Serv., in Africa are discussed and illustrated by maps. The major outbreak centres of *Locustana* in South Africa lie in the zone of contact between different ecological areas, subject to fluctuations in rainfall, which averages 10–15 inches per annum. The typical outbreak centres in the Jacobsdal district occur in areas where low ridges of blown sand, grass-covered after the rains, alternate with stretches of hard veldt with limestone outcrops. In particular, dry portions of the veldt, overgrown by *Eragrostis truncata*, serve as outbreak centres. Initial concentrations may be due to congregation on strips of veldt on which rain has fallen, and on the plants which remain green longest, and the increase of population and production of ph. *gregaria* are brought about by successive breeding of several generations during favourable rainfall seasons [*cf. R.A.E.*, A **24** 231] and subsequent oviposition in restricted areas.

In 1935 poison bait was adopted as the standard control measure against the hoppers of *Locustana*. It is prepared by mixing 92 lb. coarse whole maize meal with 7 lb. molasses and 1 lb. sodium arsenite, and coloured with vegetable black to give it a warning colouration, at the rate of 3 parts per thousand. It is issued containing about 10 per cent. moisture, moistened with 8–10 gals. water to 100 lb. before use, and broadcast at the rate of 60 lb. (dry weight) to an acre. This bait is very attractive to *Locustana*, but *Nomadacris* hoppers will only feed on it in the mornings and evenings, when they are less active; its efficiency is not diminished by rain showers and dew.

The taking of samples to estimate the mortality was facilitated by surrounding portions of resting hopper bands with iron barriers, 18 inches and 36 inches high for *Locustana* and *Nomadacris*, respectively.

WEDDELL (J. A.). **The Grasshopper Outbreak in Queensland. 1934-**
35.—*Qd agric. J.* **47** pts. 3–5 pp. 246–259, 354–364, 451–462,
 2 maps, figs. 31 Brisbane, 1937.

The known records of locust outbreaks in Queensland are given, as well as the history of the recent outbreak of *Chortoicetes terminifera*, Wlk., in different parts of that State.

The climatic conditions in south-eastern Queensland, which for the last few years had been invaded by small swarms from New South Wales, favoured extensive breeding in March–May 1934; for, following a period of abundant rainfall, March was practically rainless, and the migrating adults arriving at that time found a supply of green food and suitable weather for egg-laying. Large numbers of hoppers hatched in September, and the resultant dense swarms flew away northwards. More swarms arrived from the south, and another generation of adults was produced by early January 1935, egg-laying taking place in November and incubation lasting only three weeks [cf. *R.A.E.*, A **22** 378]. This generation was successfully destroyed by control methods, assisted by parasites and heavy rainfall. Some breeding was reported in south-eastern Queensland at the end of 1935 and again in 1936 and in early 1937. In south-western Queensland, where a dispersed population of *C. terminifera* is normally present, large migrating swarms were observed in the open plains during the 1934–35 season. Both damage and breeding were restricted owing to the prevailing drought conditions. In northern Queensland, in addition to *C. terminifera*, *Gastrimargus musicus*, F., which sometimes attacks sugar-cane in the coastal district, was reported breeding in October–November 1934 near Richmond, while in January 1935, *Austracris proxima*, Wlk., which damaged vegetables and fruit and shade trees, was particularly numerous in the wooded country in the north-west.

A brief account of the various stages and descriptions of the behaviour of the hoppers and adults of *C. terminifera* are given [cf. **25** 348]. In the early stages, the hoppers form very dense bands which move little; definite mass migrations begin two weeks after hatching. The adults migrate in fairly open formations 20–30 ft. above the ground, but the density of the swarms increases at mating time. Considerable damage, particularly by the second generation in 1934, was done to grazing, wheat, oats, Sudan grass, potatoes and lucerne, while during the season 1936–37 the swarms damaged maize, cotton, tomatoes and pumpkins. *Phaulacridium gemini*, Sjöst., attacked tobacco in one district. *C. terminifera* was preyed upon by various birds, particularly ibises, and parasitised by the larvae of the Sarcophagids, *Locustivora pachytyli*, Skuse, and *Helicobia australis*, Johnst. & Tiegs., and by red mites. The most important natural enemies, however, were *Scelio chortoicetes*, Frogg., *S. fulgidus*, Crwfs., and *S. bipartitus*, Kieff., the first two species infesting, in some egg-deposits, 60–80 per cent. of the egg-pods [cf. **25** 348].

The organisation of control and the methods used are described. After trials (in the course of which wheatmeal and pinewood sawdust proved unsatisfactory as bases for poison bait), an effective bran bait for the hoppers was prepared by dissolving separately, each in a pint of boiling water, $\frac{1}{2}$ lb. arsenic pentoxide and 4 lb. molasses, adding 9 pints cold water to each mixture, and thoroughly mixing the two. This quantity of liquid is sufficient to moisten 24 lb. bran. The bait should be applied at the rate of 36 lb. bran (dry weight) to one acre,

preferably against the early instars, during which the hoppers form compact bands. Spraying with a mixture of 1 lb. arsenic pentoxide with 2 lb. molasses and 16 gals. water, applied at the rate of 80 gals. to an acre, is recommended as an alternative.

NEWMAN (L. J.). **Grasshopper Plague** (*Austroicetes jungi*).—*J. Dep. Agric. W. Aust.* (2) **14** no. 1 pp. 24–28, 5 figs. Perth, W.A., March 1937.

Austroicetes jungi, Branc., is widespread and indigenous in the drier parts of Western Australia, where recent extensive deforestation, cultivation and subsequent abandonment of much land have increased the food supply and provided suitable habitats. It is normally confined to areas with light rainfall, since its eggs cannot develop in saturated soil, but the recent years of abnormally low rainfall have favoured the gradual building up of large swarms, which appeared in the wheat areas in the summers 1935–36 and 1936–37. Such swarms do not migrate more than 20 miles.

The egg-infested ground should be broken up thoroughly, for this destroys the eggs and makes the soil unsuitable for oviposition during the following season. Brief descriptions are given of special apparatus for mixing and distributing a poison bait for the hoppers and adults.

NEWMAN (L. J.) & MORGAN (E. T.). **Preventive and combative Measures against Potato Moth** (*Phthorimaea operculella*).—*J. Dep. Agric. W. Aust.* (2) **14** no. 1 pp. 82–86, 1 ref. Perth, W.A., March 1937.

Recommendations are made for the protection of the potato crop in Western Australia from *Phthorimaea operculella*, Zell., extensive damage having been done, particularly in dry seasons and in areas where irrigation has made possible the growing of three crops in succession.

Immediately after harvest, the tops should be gathered and burnt and the land ploughed, and during the growth of the crop, the soil should be well worked. Plants should be dusted in the early morning with a mixture of lead arsenate and sieved air-slaked lime (1 : 1), which has given some protection in experimental work. The first application should be made when the plants are 6–8 ins. high, the second 14–16 days later, and, if necessary, a third just before flowering. A similar dust may be used on seed potatoes in store, but not on potatoes kept for eating. The most satisfactory means of protecting stored tubers is fumigation with carbon bisulphide (2 lb. per 1,000 cu. ft.) for 48 hours at 75–80°F. The first treatment should be made as soon as possible after digging and the second 6–8 days later in summer or 12–16 in winter to destroy larvae hatched from eggs and also pupae that survived the first treatment. A third application may be made if necessary, but never more. After treatment, tubers must be stored in moth-proof buildings. Light-traps capture many moths.

COOLHAAS (C.). **Jaarverslag Oogstjaar** [Annual Report of the Vorstenland Tobacco Experiment Station, Java] **1935–1936**—*Meded. Proefst. vorstenl. Tab.* no. 84, 88 pp. Klaten (Java), 1937.

In his report on the phytopathological division (pp. 25–42), T. H. Thung notes that the results appear to justify the use of the measures

suggested in the previous year against the thrips [*Isoneurothrips parvispinus*, Karny] attacking tobacco in the Vorstenland district, viz., spraying seedlings with derris and flooding the beds [R.A.E., A 24 668]. It has been recorded that well irrigated cotton plants have a lower degree of infestation by *Thrips tabaci*, Lind., and that the heavy water supply promotes surface caking of the soil which is unfavourable to pupation [16 149]. Other sources of infestation by *I. parvispinus* include soy beans (*Glycine soja*) and *Capsicum annuum*. *Phthorimaea helipoa*, Lw., proved very destructive in two plantations, having spread from neglected tobacco plants.

LI (Feng-swen) & CHOU (Shao-mu). **The Distribution of important Cotton Insects recorded in Chinese Literature.** [In Chinese.]—Ent. & Phytopath. 5 no. 15–16 pp. 282–302, 15 maps, 181 Chinese refs. Hangchow, 1st June 1937. (With a Summary in English.)

A list of the chief pests of cotton in China is compiled from the literature, with references to over 200 periodicals. Those dealt with include *Platyedra (Pectinophora) gossypiella*, Saund., *Aphis gossypii*, Glov., *Agrotis* spp., *Earias cupreoviridis*, Wlk., *Sylepta derogata*, F., *Tetranychus telarius*, L., *Empoasca (Chlorita) biguttula*, Mats., and *Heliothis armigera*, Hb. (*obsoleta*, F.). Maps show the distribution of each, and notes are given on the severity of injury and the year in which each record was made.

SEN (H. K.). **Entomological Section.**—Rep. Indian Lac Res. Inst. Namkum 1936–37 pp. 12–22. Calcutta, 1937.

Except for a severe attack by *Aspidiotus orientalis*, Newst., host trees of *Laccifer lacca*, Kerr, at Namkum (Bihar) were singularly free from pests during the year under review. The 15th generation of the parthenogenetic strain of *L. lacca* is developing satisfactorily [cf. R.A.E., A 25 531], and no diminution in the quantity of resin was observed. Attempts are being made to produce standard strains by cultivation in vitro.

The average parasitism of *L. lacca* for the year was 6·2 per cent., and the percentage of hyperparasitism also remained low. In August 1936, a sample of lac, thought to be *L. javanus*, Chamb., was received from Java and *Eublemma amabilis*, Moore, and *Holcocera pulvrea*, Meyr., were bred from it. Tests on the longevity of *H. pulvrea* showed that adults supplied with 2 per cent. solutions of cane sugar or glucose lived longer than those supplied only with water, and that these lived considerably longer than those kept without water.

The average percentage parasitism of *E. amabilis* by *Microbracon greeni*, Ashm., was 18·1, as compared with 13·1 in the previous year [loc. cit.]. In work on rearing it, a concentration of 10 male to 20 female parasites in oviposition cages containing 20 hosts gave better results than one of 5 to 15. *M. greeni* did not parasitise larvae of *Ephestia* sp. on rice, but oviposited on *Cataglyphis bicolor*, F., and *Platyedra gossypiella*, Saund.; adults reared from the latter oviposited freely on larvae of *E. amabilis*.

During the year, 23 generations of *Microbracon hebetor*, Say, parasitising both *E. amabilis* and *H. pulvrea*, were bred from stock originally received from Ceylon [cf. loc. cit.] This Braconid was successfully reared on *Hieromantis ioxysta*, Meyr., and one adult was bred from eggs

deposited on *Tonica nivifera*, Wlk., infesting *Bombax malabaricum*. It was also bred in one instance as a hyperparasite of the mature larvae of *Pristomerus testaceicollis*, Cam., parasitising *H. pulverea*. The latter is sometimes parasitised by both *Apanteles tachardiae*, Cam., and *M. hebetor*, the species in the more advanced state of development surviving.

The average percentage parasitism of *H. pulverea* by *A. tachardiae* during the year was only 3·6, as compared with 6·6 in the previous year. This Braconid was successfully reared in the laboratory, but similar work with *P. testaceicollis* failed. A Bethylid ectoparasite, reared from *H. pulverea* was identified as a species of *Perisierola*. One individual of *Elasmus albomaculatus*, Gah., was also bred from the Gelechiid.

LINKE (A.). Szkodliwe występowanie przypłaszczka granatka w lasach Wielkopolski (*Phaenops cyanea* Fabr.). Streszczenie. [An Outbreak of *P. cyanea* in the Forests of Great Poland. Abstract.]—

Roczn. Nauk rol. **41** pp. 439–441. Poznań, 1937. (With a Summary in German.)

The Buprestid, *Melanophila (Phaenops) cyanea*, F., caused considerable injury in the Province of Poznan in 1935 and 1936 in forests of pines from which resin was obtained. In 1935 this pest was present in a stand consisting of trees 80 years old, the most severe infestation occurring on the south-eastern edge, which had been suddenly exposed to the sun by the felling of the adjoining plot in the preceding year. In individual trees it was also the south-eastern side that was chiefly attacked. Most of the larvae were observed under strips of thick bark at the sides of the incisions made for drawing the resin, which appears to confirm the observation that it attacks weakened trees [cf. *R.A.E.*, A **22** 199].

SZELÉNYI (G. I.). Researches on the Development and Epidemiology of *Aspidiottus pyri* (Licht.) Reh, on the Generation of the Year 1935. [*In Magyar.*]—*Rep. Hung. agric. Exp. Sta.* **39** repr. 12 pp., 15 refs. Budapest, 1936. (With Summaries in German and English.) [Recd. 1937.]

Aspidiottus pyri, Licht., is widely distributed throughout Hungary on various food-plants, including apple and pear trees, though infestation is seldom severe. Observations were made in 1935 on the mortality of its stages. Hibernation occurs in the second larval instar, in which mortality was about 29 per cent. Winged males were found from late April to mid-May, mature females from mid-May and eggs from mid-June. Active larvae were observed from mid-June until September. The first moult began in mid-August. Mortality of eggs and young active larvae reached 90–95 per cent. between 21st June and early July, when the temperature was very high, the maximum on 28th June being 41°C. [105·8°F.] Mortality of egg-laying females, however, rarely reached 2 per cent., and that of inactive larvae was 10–15 per cent. Up to the beginning of winter, mortality of second-instar larvae was 5 per cent. During the summer, 20 and 5 per cent., respectively, of ovipositing females were attacked by *Aphytis (Aphelinus) mytilaspidis*, LeB., and *Azotus marchali*, How. Mortality and parasitism occurred chiefly on the south and south-west of the tree, while on the north the latter was only 1–2 per cent. From

these figures, it is calculated that the mortality coefficient for *A. pyri* is 95.26 per cent., and that a mortality rate of 98.89 per cent. gives a balance in population numbers.

HERING (M.). Die Blatt-Minen Mittel- und Nord-Europas. [The Leaf-mines of Central and North Europe.]—Lief. 4, pp. 337–448, 101 figs., 2 pls.; Lief. 5, pp. 449–560, 103 figs., 1 pl. Neubrandenburg, G. Feller, 1937. Subscription Price, M. 9 per Lieferung; separately M. 13.5. (In Germany and Switzerland M. 12 & M. 18.)

In these fourth and fifth parts of a series of keys to leaf-mines caused by insects [R.A.E., A 24 17, 405, 671], keys are given from *Myrica* to *Zinnia*.

DIAKONOFF (A.). De rijstmot, *Corypha cephalonica* St. (Lep. Galleriidae) een in Nederlandsch-Indië en in Nederland nog weinig bekende vijand van tropische en andere producten. [The Rice Moth, *C. cephalonica*, a Pest of tropical and other Products as yet little known in the Netherlands Indies and in Holland.]—Ber. HandMus. kolon. Inst. Amst. no. 112, 22 pp., 5 figs., 50 refs. Amsterdam, 1937. (Repr. from *De Indische Mercuur* 60 no. 24 p. 359, 16th June 1937.) (With a Summary in English.)

The rice moth, *Corypha cephalonica*, Stn., has been bred at Amsterdam from rice flour received from a warehouse at Haarlem. This tropical Pyralid, which appears able to live in temperate climates, may have become established in Holland, and existing knowledge of its bionomics and control is therefore reviewed from the literature [R.A.E., A 7 428; 22 488, etc.].

VAYSSIÈRE (P.) & LEPESME (P.). Les bostrychides des produits alimentaires en magasin.—Agron. colon. no. 233 pp. 129–141, 7 figs., 14 refs. Paris, May 1937.

The synonymy, distribution, life-history and natural enemies of *Rhizophorha dominica*, F., and *Dinoderus minutus*, F., in stored grain are reviewed from the literature. All stages of the former, and the adult and larvae of the latter are described and control measures are summarised. Brief notes are added on other species of *Dinoderus*.

BÉGUÉ (H.). Le dosage du fluor dans les produits insecticides.—Ann. agron. (N. S.) 7 no. 3 pp. 431–439, 15 refs. Paris, 1937.

An account is given of experimental tests on the accuracy of laboratory methods for estimating fluorine in insecticides. The author concludes that the best methods are those of A. Bonis and J. Frère. In the former the fluorine is precipitated as calcium fluoride and so weighed; excellent accuracy was obtained in the estimation of fluorine in barium fluosilicate. However, this method was slow, needed modification in the presence of phosphates, and the results tended to be low owing to the solubility of the calcium fluoride in water and in the acetic acid used in its separation. The second method, which is described in detail, is a volumetric one employing yttrium nitrate. This also gave good results for mixtures containing barium fluosilicate and cryolite, and was conveniently rapid.

DAVIES (W. M.). **Preliminary Tests with Slate-dust for the Control of Fleabeetles.**—*Welsh J. Agric.* **13** pp. 317-320, 3 refs. Cardiff, 1937.

In experiments on the control of *Phyllotreta* spp. on young swede and turnip seedlings in North Wales in 1935, swede seed was soaked for 20 minutes in the following repellents that were found not to affect germination: oil of wintergreen, kerosene, orthodichlorobenzene, 5 per cent. pine-tar oil and 2½ per cent. cedar-wood oil. These treatments proved ineffective. In further tests, the physical effects of covering the seedlings with a fine slate dust were compared with the control obtained by other insecticidal dusts [R.A.E., A **23** 221; **24** 264]. Slate dust has excellent covering qualities and spreads over moist leaves in a thin film that adheres very efficiently. A grade of 250 mesh tended to clog the dusting machine, and was almost twice as costly as, and no more efficient than, one of 100 mesh. At the rate of 1 cwt. to the acre, applications of 250 and 100 mesh slate dust, grade 16 naphthalene, 100 mesh slate dust mixed with derris (4:1), and with naphthalene (4:1), and 5 lb. 100 mesh slate dust to 1 fluid oz. orthodichlorobenzene, reduced the percentage infestation from 79, 83, 76, 84, 89 and 88 to 10, 2, 30, 15, 7 and 6, respectively; with $\frac{3}{4}$ cwt. derris per acre there was a reduction from 74 to 8 per cent., but the cost was prohibitive.

ROEBUCK (A.). **Notes on the economic Zoology of Lincolnshire during 1936.**—*Trans. Lincs. Nat. Un.* 1936 pp. 112-115. Louth, 1937.

Insects of economic importance observed in Lincolnshire during 1936 included *Tetropium gabrieli*, Weise, which caused much damage to larch trees in one locality, and *Tinea granella*, L., and *Endrosis lactella*, Schiff., on sacks and grain in a store.

WILSON (G. F.). **Pests of Ornamental Garden-plants.**—*Bull. Minist. Agric.* no. 97, v + 128 pp., 36 pls., text illus., many refs. London, H.M.S.O., 1937. Price 3s. 6d.

This bulletin deals with the control of the common pests of lawns, flowering plants and ornamental trees and shrubs in England. In the first part, the various control measures and in the second, the habits and control of general pests are summarised. The third is divided into subsections, each concerned with the control of the insect and other pests of different types of plants, short descriptions and notes on the bionomics being in many cases included.

CHRYSTAL (R. N.). **Insects of the British Woodlands.**—Demy 8vo, xiii + 338 pp., 33 pls., 60 refs. London, F. Warne & Co. Ltd., 1937. Price 7s. 6d.

This is a practical textbook, intended primarily for foresters but also as a general work of reference, on the insects associated with forest and ornamental trees in Britain. It contains a preliminary account of the structure, metamorphosis and classification of insects, followed by general descriptions of the different stages and bionomics of the more important forest insect pests classified under orders, each divided into subsections according to the damage caused. Finally, there are notes on the study and collection of insects, the conditions

under which infestations arise in forests, and the different aspects of control, including methods of preparation and application of different fumigants, sprays and baits. Amongst biological methods, particular stress is laid on the value of birds in forest economy.

There are two appendices. The first contains specific descriptions of the chief insects already dealt with and lists of their food-plants. In the second, the insects are classified according to the type of injury, with a list of the trees concerned and references to the text.

THIEM (H.). Von aussergewöhnlichen Ohrwurmpfagen in Wohnhäusern. [Unusual Earwig Plagues in Dwellings.]—*Z. PflKrankh.* **47** no. 7 pp. 380–394, 3 figs. Stuttgart, 1937.

An account is given of some mass infestations of houses in Germany by *Forficula auricularia*, L. Thorough field sanitation should be practised around the houses. Damp sacks are useful traps, and a poison bait should be strewn indoors and out every third evening. It should be prepared by dissolving $\frac{3}{4}$ lb. sodium fluoride or sodium fluosilicate in 1 gal. tapwater and adding $\frac{1}{2}$ gal. molasses. This solution is stirred with 15 lb. wheat bran to form a crumbly mass, the keeping quality of which may be enhanced by adding $\frac{1}{2}$ lb. glycerine. The mixture is allowed to stand for 1–2 days for the bran to become impregnated. The bait is poisonous to man and poultry.

RIGGERT (E.) & GOFFART (H.). Zur Frage der Kohlfliegenbekämpfung an der Westküste Schleswig-Holsteins. [Regarding the Control of the Cabbage Fly on the West Coast of Schleswig-Holstein.]—*Z. PflKrankh.* **47** no. 7 pp. 394–401, 1 fig., 4 refs. Stuttgart, 1937.

The cabbage fly, *Phobia brassicae*, Bch., has caused considerable injury to cabbages grown in the fertile marshland district in western Schleswig-Holstein. In 1934, the first adults and eggs were seen in the seed beds on 2nd May, two days later eggs were common and on 7th May the first larvae were noticed. As the flies apparently migrate from meadows, etc., to crucifers when ready to oviposit, the correct timing of control measures requires daily inspection of the fields in spring.

In Germany poor results in combating *P. brassicae* with finely ground naphthalene were obtained at Aschersleben [R.A.E., A **23** 120] in the dry year 1933, and, in a communication from that station, it is stated that flake naphthalene gave only slightly better results there in the similarly dry year 1934, but that on moorland soil, which is moist, it gave results equal to carbolineum and only a little inferior to mercury bichloride. The authors' tests were made with mercury bichloride, "Kortofin" (a proprietary preparation of mercury), fruit-tree carbolineum and different forms of naphthalene, all of which gave results against the larvae. Finely ground naphthalene evaporated within 3–5 days and scorched the root-collars. Flake naphthalene, if applied to previously loosened soil and not finely ground, remained effective for over 12 days, in spite of heavy rain. It was observed that *P. brassicae* oviposited on cabbages after the applications, indicating that it is chiefly the larvae that are caused to migrate. In the tests, no harm was done to the young seedlings by either mercury bichloride or "Kortofin" in 0·05 per cent. solution or with fruit-tree carbolineum of 0·2 and 0·1 per cent. strength.

Die ersten diesjährigen Kartoffelkäferfunde an der Westgrenze. [The first Records in 1937 of the Potato Beetle at the western Frontier of Germany.]—*NachrBl. dtsh. PflSchDienst* **17** no. 7 p. 54. Berlin, July 1937. **Weitere Kartoffelkäferfunde an der Westgrenze.** [Further Records.]—*T.c.* no. 8 pp. 61–62. August 1937.

Records are given of the occurrence in Germany [*cf. R.A.E.*, A **24** 799] of *Leptinotarsa decemlineata*, Say, from 31st May to 20th July 1937, in 1 locality nearly a mile from the Luxembourg frontier, and in 26 localities at distances ranging up to 30 miles from the French frontier.

[**The Spread of *Polychrosis botrana*, Schiff., in Germany.**]—*NachrBl. dtsh. PflSchDienst* **17** no. 7 p. 54. Berlin, July 1937.

Larvae of *Polychrosis botrana*, Schiff., were observed in June 1937 in inflorescences of grape-vines in Berlin and at Dessau. Previous records of this vine-moth have been confined to the vineyard regions [*R.A.E.*, A **25** 581].

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*Beil. NachrBl. dtsh. PflSchDienst* **9** no. 5 pp. 106–120. Berlin, 1st July 1937.

This part includes the text of a regulation dated 17th April 1937 for the control by means of trap trenches of *Otiorrhynchus ligustici*, L., attacking lucerne in Saxony. The trenches must be at least 10 ins. deep with vertical or, preferably, overhanging sides, and have trap holes 20–30 yds. apart in which the weevils assemble and where they can be crushed or burned. They must be dug when migration begins, and in any case not later than 5th April, round lucerne and clover fields that have been ploughed under during the preceding two years, trenches round young lucerne being also desirable. All lucerne or clover fields ploughed under between 6th and 30th April must be immediately surrounded by trenches.

PHILIPP (W.). Wichtige Feinde des Beerenobstes. [Important Enemies of Bush Fruits.]—*Kranke Pflanze* **14** no. 7–8 pp. 121–124, 1 fig., 1 pl. Dresden, 1937.

This is a popular account of the bionomics and control of *Byturus aestivus*, L. (*fumatus*, F.), *Pennisetia (Bembecia) hylaeiformis*, Lasp., and *Aegeria (Sesia) tipuliformis*, Cl., attacking bush fruits in Germany.

ROESLER (R.). Drehherzkrankheit und Herzlosigkeit bei Kohl. [Deformed Heart Disease and Destruction of Heart in Cabbage and similar Crucifers.]—*Kranke Pflanze* **14** no. 7–8 pp. 124–129, 2 pls. Dresden, 1937.

Deformed heart in cabbage, cauliflower and related crucifers is caused in Germany by the larvae of *Contarinia nasturtii*, Kieffer (*torquens*, de Meij.) feeding in the leaf-stems, which often results in the decay of the head due to bacteria entering the injured parts. *C. nasturtii* may have five generations, the fifth being very scanty. The second and third do the most harm. The generations vary greatly in size, but occur at remarkably regular dates that enable

a spray calendar to be given. The best method of control is spraying from above into the hearts a solution containing 0·1–0·15 per cent. crude nicotine and 0·5 per cent. soft soap, this being preferable to derris or pyrethrum. Three applications, on 12th, 18th and 24th June, are directed against the second generation, and three on 9th, 15th and 24th July, against the third, four being sometimes desirable. Spraying on 25th May and 2nd June against the first generation, or on 12th, 19th and 25th August against the fourth is only occasionally necessary. No spraying is needed against the fifth. Seedlings in frames are liable to attack at dates different from those in the field and must be sprayed at 8-day intervals throughout the season from late April onwards.

The destruction of the heart, which occurs chiefly in cauliflowers, is due to various causes, including insects other than *C. nasturtii* [cf. R.A.E., A 24 678].

SCHIMITSCHEK (E.). **Forstschädlingsaufreten in Oesterreich 1936.**

[Forest Pests in Austria in 1936.]—*Zbl. ges. Forstwes.* **63** 1936 pp. 1–25, 8 figs. (Abstr. in *Neuheiten PflSch.* **30** no. 3 p. 116–117. Vienna, June 1937.)

Among the pests recorded in Austria in 1936, *Phyllococta vulgarissima*, L., attacked four varieties of willow and was checked only by a flood. The adults of *Otiorrhynchus sensitivus*, Scop., fed on the May shoots of spruce and *Pinus silvestris* in nurseries. They should be collected during the chief flight periods, which in 1936 were from 10th April to 10th May and again from 10th to 20th August. In Styria, *O. chrysocomus*, Germ., weakened spruce and *Pinus cembra* in nurseries by feeding on the needles and shoots. *Cryphalus piceae*, Ratz., was the principal bark-beetle attacking silver fir [*Abies*] at the edge of its area of natural distribution. *Aphrophora salicis*, DeG., was a serious pest of basket willows. *Dioryctria abietella*, Schiff., injured the cones and the cone-bearing shoots of balsam firs [*Abies balsamea*].

SPRINGER (W.). **Beobachtungen bei Borkenkäferaufreten der Jahre 1931 bis 1932.**

[Observations during Bark-beetle Outbreaks in 1931–32.]—*Wien. allg. Forst. u. Jagdztg.* **54** 1936 pp. 201–202. (Abstr. in *Neuheiten PflSch.* **30** no. 3 pp. 119–120. Vienna, June 1937.)

After a storm in July 1932, the chief pest of spruce in Upper Austria was *Ips typographus*, L., *I. (Pityogenes) chalcographus*, L., being more inclined to primary feeding. The large wind-thrown areas were infested at the edges only, but the gaps due to the storm were heavily attacked.

SCHIMITSCHEK (E.). **Schädlinge und Schädlingsbekämpfung im Ausschlagwald.**

[Pests and Pest Control in Coppices.]—*Wien. allg. Forst. u. Jagdztg.* **54** 1936 pp. 101–103, 107–108. (Abstr. in *Neuheiten PflSch.* **30** no. 3 p. 120. Vienna, June 1937.)

This paper contains a table showing the infestation by nine insect pests on 18 varieties of willow in Austria. At Wallsee, on the Danube, the sawfly, *Caliroa annulipes*, Klug, was observed only on *Salix americana*. Collection by jarring in the early morning is recommended

against infestation by May beetles [*Melolontha*] ; the rods should be cut in June and September in cases of infestation by the Noctuid, *Earias chlorana*, L., and alders should be used as traps for *Cryptorhynchus lapathi*, L. In the case of total infestation by the Cercopid [*Aphrophora salicis*, DeG.], the willow plantations should be burned, and they should be flooded if there are many Chrysomelid pupae in the ground. Nests of the oak processionary caterpillar, *Thaumetopoea processionea*, L., must be burned.

BERAN (O.). **Forstentomologische und forstschatzliche Untersuchungen auf dem Gebiete von Lunz. IV. 2. Der Südhang. Bestand und Kahlfläche. Verhältnisse an verschiedenen exponierten Bestandesrändern.** [Investigations in Forest Entomology and Forest Protection in the Lunz District. IV. 2. The South Slope. The Stands and Clear Fellings. Conditions at differently exposed Stand Edges.]—*Zbl. ges. Forstwes.* **62** 1936 pp. 257–279, 289–312, 4 figs. (Abstr. in *Neuheiten PflSch.* **30** no. 3 p. 121. Vienna, June 1937.)

In further studies in the Lunz district, Austria [cf. *R.A.E.*, A **22** 144, etc.], the larvae and pupae of *Ips (Pityogenes) chalcographus*, L., hibernated on the northern side of the Maisszinken mountain, but on the southern side young adults of the second generation were already present in autumn. These adults and *Monochamus sutor*, L., attacked a trap tree in the felled area, but the latter was not observed on a trap tree in a closed stand. On the southern side one generation was completed in a year, but on the northern it required 18 months. *M. sutor* was parasitised by *Ephialtes tuberculatus*, Geoff., and *Helcon ruspator*, L. (*dentator*, Nees). The trap tree lying in the stand was infested by *Dryocoetes autographus*, Ratz., which was parasitised by *Rhopalicus suspensus*, Ratz.

RIVNAY (E.). **Moisture as the Factor affecting Wing Development in the Citrus Aphid, *Toxoptera aurantii*, Boy.**—*Bull. ent. Res.* **28** pt. 2 pp. 173–179, 7 refs. London, July 1937.

In an investigation in Palestine of the factors causing the development of wings in certain groups of Aphids [cf. *R.A.E.*, A **7** 299; **9** 532; **12** 118; **15** 533; **16** 372; **25** 517], *Toxoptera aurantii*, Boy., was bred on *Citrus* twigs under controlled conditions of temperature, humidity, crowding and food-supply. No effect on wing-development was observed during continuous breeding for more than two years at a range of temperatures from 14 to 32°C. [57·2–89·6°F.], although the retardation in the development of the insect at low temperatures and the acceleration at high ones modified the influence of other factors on wing-production. In experiments, crowding in itself was not found to cause wing-development. On stale food, the percentage of alates was high and the number of such forms decreased when fresh food was supplied to the young larvae. When Aphids were reared on stale but vigorously growing and succulent twigs, few alate individuals were produced, but on twigs allowed to dry for a day, then placed in water, then again allowed to dry and so alternately until the Aphids matured, 48 alates and 63 apterae developed, whereas on the

control (when the twig was not removed from water) 10 alates and 111 apterae developed. It was therefore concluded that loss of water rather than the amount of food ingredients ingested by the Aphids affected the wing-development, and that the decisive factor is not the water content of the food itself but the balance of water in the body of the Aphid.

In the field, migratory females settled on soft twigs only, and as soon as the twig matured and became less succulent, a greater percentage of the larvae born on it were alate and left it as soon as they could fly. The percentage of larvae that become alate is greater on old mature leaves than on young growing tips of twigs, probably owing to the difference in water content of the two. The factors previously thought to cause wing-development are discussed, such as light, temperature and crowding, the presence of chemicals in the water, etc., and it is pointed out that all these exert a direct or indirect influence on the balance of water in the bodies of the Aphids, which in turn causes wing-development.

LE PELLEY (R.). Notes on the Life-history of *Cheiloneurus noxius*, Compere (Hym.).—Bull. ent. Res. 28 pt. 2 pp. 181–183, 1 fig., 2 refs. London, July 1937.

In California, the female of *Cheiloneurus noxius*, Comp., when searching for *Metaphycus lounsburyi*, How., which is a primary parasite of *Saissetia oleae*, Bern., rejects scales the contents of which are liquid, and spends some time boring through scales that are not parasitised and attempting others that are too tough. The egg is deposited free in the body of the primary parasite and hatches in 4–5 days. There are three larval instars, lasting 2–3, 2–4, and 3–5 days, respectively, and the pupal stage lasts 4–6 days. The life-cycle from egg to adult at 27–32°C. [80·6–89·6°F.] may be completed in 14 days. Virgin females produced only male offspring. As many as 18 individuals of *Metaphycus*, on which *Cheiloneurus* was reared, developed on one *Saissetia*. Not more than one *Cheiloneurus* reached maturity in a single *Metaphycus*, but each primary parasite may be attacked, so that up to 11 *Cheiloneurus* emerged from a single scale; in this case no primary parasite emerged. One hundred scales that had been exposed to attack by *Metaphycus* were later exposed to several *Cheiloneurus* for 24 hours, and from the 86 scales attacked, 393 *Metaphycus* emerged and 151 *Cheiloneurus*. In the field *Cheiloneurus* is not usually abundant, and it does not seem to decrease the beneficial activities of *Metaphycus*.

HANSON (H. S.). Notes on the Ecology and Control of Pine Beetles in Great Britain.—Bull. ent. Res. 28 pt. 2 pp. 185–236, 3 pls., 8 figs., 24 refs. London, July 1937.

A preliminary survey is made of the ground to be covered by an investigation of the possible methods of control of injurious insects in pine forests in Britain, with a view to the reduction or prevention of damage caused by them, and with special reference to the pine beetle, *Myelophilus piniperda*, L.

The following is based on the author's summary and conclusions : An analysis is made of the various types of damage caused by *Myelophilus*, and it is shown that although the actual damage caused in any particular year may be comparatively slight, the effects of successive outbreaks are cumulative and frequently result in a great reduction in the value of the crop. The occurrence of bark-beetle outbreaks and the conditions under which they occur are briefly described, and factors affecting the pine beetle population are discussed. In the absence of large quantities of suitable breeding materials, the increase of bark-beetles and wood-boring insects in pine forests is favoured by the vigorous growth of young trees, as large numbers are then suppressed and killed in the pole stage as a result of the rapidly increased shade due to abnormal development of predominant trees. Increase of bark-beetles is also favoured by bad drainage and a waterlogged soil, which are unfavourable to the crop. Examples are given of the operation of overcrowding in the limitation of the bark-beetle population, and it is shown that this factor can be utilised in practice by limiting the supply of suitable breeding material. Pathogenic organisms are of little importance in the control of bark-beetles, as although they may cause an epidemic when the pest has reached its maximum abundance, the object of control measures is to prevent the population from approaching that stage of density. The effects on bark-beetles of parasitism by Nematodes is discussed.

A list is given of the Hymenopterous parasites of pine bark-beetles, together with notes on their relative abundance. The Pteromalid, *Rhopalicus tutela*, Wlk., is the most important parasite of *Myelophilus piniperda* in Britain, where it was present in every locality visited. During the winter of 1933-34, 64,600 larvae parasitic on *Myelophilus* were found per acre on a sample plot, and more than 99 per cent. of these were *R. tutela*. It also attacked other pine beetles, including the weevil, *Pissodes notatus*, F. Other parasites reared from bark-beetles in the course of the work were the Pteromalids, *R. brevicornis*, Thoms., *Rhoptrocerus xylophagorum*, Ratz., and *Pteromalus bidentis*, Ratz.; the Braconids, *Coeloides abdominalis*, Zett., *Dendrosoter midden-dorffi*, Ratz., *D. hartigi*, Ratz., *D. protuberans*, Nees, and *Calyptus atricornis*, Ratz.; the Eurytomid, *Eurytoma auricoma*, Mayr., and the Eupelmid, *Eupelmus urozonus*, Dalm. All these, except *P. bidentis*, *D. hartigi* and *D. protuberans*, were reared from *M. piniperda*, but *Eupelmus* was probably a hyperparasite, and *Eurytoma* was definitely so, attacking *Rhopalicus tutela*, though possibly also primary. A list of the Coleopterous predators found associated with the bark-beetles is given, with notes on the most important species. Beetles of the genus *Rhizophagus* appear to be by far the most important enemies of these pests. Some species of Coleopterous predators such as *Thanasimus formicarius*, L., and Elaterids, are probably more injurious than beneficial, owing to the destruction of parasite larvae. The larvae of several Diptera were numerous in the brood galleries of the bark-beetles, where they probably destroy more parasites than hosts, and a list is given of the species that have been identified. Although under certain conditions birds destroy many adult bark-beetles, this is counterbalanced by the destruction of parasite larvae in the winter. The effects of competition between different species of bark-beetles are discussed, with special reference to *Crypturgus cinereus*, Hbst., and its influence in the control of *Myelophilus minor*, Htg.

A detailed description is given of some large-scale thinning experiments, which have been in progress in the New Forest since 1933. Observations by the author over a period of years showed that parasites and predators of the pine beetles were most numerous in young unthinned pine stands in the pole stage, and the conclusion was reached that under such conditions the bark-beetles were controlled biologically. To maintain such control, the establishment of resident populations of natural enemies on a permanent host population is necessary. The density of the latter is largely governed by the amount of suitable breeding material available, and an increasing population requires a corresponding increase in breeding material from year to year. When the supply of suitable breeding material fails, overcrowding of the brood takes place. The intersection of the larval tunnels facilitates the work of destruction by the predator larvae, and the balance is, for a time, turned in their favour. The increased density of the host population also favours the increase of the parasites at the expense of the host and, through a shortage of food, results in a high mortality among the bark-beetle larvae. There is then a sudden reduction in the bark-beetle population, which is followed by a corresponding reduction in the parasite and predator populations. Thus under natural conditions there is considerable fluctuation in the ratio of the host population to the parasite and predator populations. Each cycle may extend over a considerable period of years, the peak of infestation by bark-beetles corresponding with the period of maximum density of the crop. The automatic opening-up of the canopy results in a temporary reduction in the amount of suitable breeding material. Under silvicultural conditions, outbreaks are precipitated by the sudden increase of available breeding material produced after thinning, if the material is allowed to remain in the vicinity. In theory the elimination of all suitable breeding material would solve the problem of control, but the method is often impracticable when dealing with large areas of forest, as is shown by the frequency with which bark-beetle outbreaks occur as a result of thinning operations. In the investigation, each year parts of plantations of trees 20 and 30 years old were thinned in strips, leaving the thin-barked material of small diameter for the maintenance of a permanent population of parasites and predators. The infestation of bark-beetles was noted each year in all the different experimental plots and the control plots.

The results of the investigation suggest that it is desirable to defer the first thinning of stands of Scots pine [*Pinus sylvestris*] until the combined effects of overcrowding and biological control weaken. This occurs when the amount of suitable breeding material in the form of suppressed trees tends to equal the minimum requirements of an increasing resident population. The age of the forest at which this stage is reached may vary not only in different localities, but also for different parts of the same crop, according to the rate of growth. The original planting distance is also a factor of importance. In practice a dense crop of natural regeneration on comparatively poor sandy soil can be maintained at a greater density and for a longer period without risk of an outbreak, and may ultimately produce a more valuable crop, than forest planted in wide spacing under conditions suitable for rapid growth. The use of billets and trap-stems, control measures in felling, burnt and windfall areas and forestry operations that tend to upset the balance are discussed.

EDNEY (E. B.). **A Study of spontaneous Locomotor Activity in *Locusta migratoria migratorioides* (R. & F.) by the Actograph Method.**—*Bull. ent. Res.* **28** pt. 2 pp. 243-278, 16 figs., 23 refs. London, July 1937.

The following is taken mostly from the author's summary: In order to provide quantitative data on spontaneous activity shown by locusts, the activity of different instars of *Locusta migratoria migratorioides*, R. & F., ph. *solitaria*, was recorded by means of an actograph apparatus, adapted for recording in 24-hour periods. This is described, and the results are expressed in terms of distances travelled.

The amount of activity varied greatly in different individuals and in the same individuals from day to day. However, over each instar the highest level of activity occurred about half-way between moults, with a falling off towards the beginning and end of each instar; there was intense activity immediately before a moult in the absence of a convenient moulting place. There was no significant difference between the mean daily activity of males and females [cf. *R.A.E.*, A **25** 75] or between sexually mature and immature individuals, but the diurnal distribution of activity of adults up to seven days old was similar to that of hoppers. The distances travelled in a 24-hour period in the 4th and 5th were greater than in the 2nd and 3rd instars.

The distribution of activity over the 24-hour periods was unequal, the insects being always most active during the second twelve hours. This was found to be due to the absence of fresh green food, which was introduced at the beginning of the 24-hour experiment, the activating effect of the starvation lasting for 36 hours after the last opportunity for feeding, and being most pronounced in the earlier instars [cf. **24** 396]. Changes in relative humidity from 95 to 35 per cent. had little effect on activity [cf. **25** 75].

A diurnal periodicity in activity was induced in insects reared under alternating 12-hour periods of light and dark, and persisted for a few days when they were kept in continual darkness.

In some records there was a tendency for periods of high activity to recur every 2-2½ hours, and the preliminary experiments with a trophograph suggested that this periodicity is associated with a hunger rhythm.

KING (C. B. R.). **Notes on the Life-history of *Eriophyes carinatus*, Green.**—*Bull. ent. Res.* **28** pt. 2 pp. 311-314, 4 refs. London, July 1937.

Notes are given on the bionomics of *Eriophyes carinatus*, Green (purple mite), a minor pest of tea in Ceylon [cf. *R.A.E.*, A **25** 334], with brief descriptions of all stages, including the egg, which has not hitherto been recognised. The mite appears to prefer the upper surface of the leaf, possibly because of its smoothness. After a severe attack, the leaves turn bronze and both surfaces are covered with the cast skins of the mites. The egg, larval and nymphal stages lasted 6, 1 and 3-4·7 days, respectively, the last comprising two nymphal instars of 1·25-2·7 and 1·7-2 days. The preoviposition period lasted 2 days. Females laid up to 13 eggs at the rate of 1-2 a day. The species exhibits arrhenotokous parthenogenesis. This mite is not so serious a pest as *Tarsonemus translucens*, Green, or *Tetranychus*

bioculatus, W.-M., and is at present controlled naturally; in case of an outbreak, however, a light application of fine sulphur dust should check it.

FERRIÈRE (C.). **Notes on two new Oriental Parasites of the Coffee Mealy-bug (*Pseudococcus lilacinus*)**.—*Bull. ent. Res.* **28** pt. 2 pp. 315–320, 2 figs., 12 refs. London, July 1937.

Descriptions are given of both sexes of *Pseudaphycus orientalis*, sp. n., and *Anagyrus lilacini*, sp. n., which parasitise *Pseudococcus lilacinus*, Ckll., in the Philippine Islands. They were bred by R. H. le Pelley during a search for parasites for introduction into Kenya against coffee mealybugs. A key to the species of *Pseudaphycus* is given.

VAN EMDEN (F.). **An Indian Cerambycid damaging Tea Cases**.—*Bull. ent. Res.* **28** pt. 2 pp. 321–323, 2 figs. London, July 1937.

In November 1936, larvae identified as *Stromatium barbatum*, F., were found damaging tea chests that had not been touched since their arrival in London from India in March 1936. This Cerambycid has hitherto only been known from Madagascar to Burma and the Andaman Islands, where it attacks practically all sorts of dry wood, hard and soft. The chests were constructed of three-ply wood, probably Scandinavian, which had been in India for about 18 months before use. The larvae bored large flat cavities, which reached to within 4 mm. of the outside of the wood. The chests thus appeared to be intact, although in some places a very light pressure would crush the thin outer wall and expose the tin. Younger larvae mainly attack the central layer so that the board then appears sound. Creaking sounds reveal the activities of the larvae.

LEVER (R. J. A. W.). **Economic Insects and Biological Control in the British Solomon Islands**.—*Bull. ent. Res.* **28** pt. 2 pp. 325–331, 3 figs., 13 refs. London, July 1937.

In this paper, work on the economic entomology of the British Solomon Islands Protectorate conducted subsequently to 1932 [cf. *R.A.E.*, A **21** 482] is reviewed [cf. **23** 281; **24** 329, 568, 569; **25** 347].

Insect pests of economic plants include *Nacoleia octasema*, Meyr., and *Lagoptera regia*, Lucas, on bananas; *Tirathaba rufivena*, Wlk., *Brontispa froggatti*, Sharp, and the weevil, *Meredolus cocotis*, Mshl., on *Areca catechu*; *Dysdercus decussatus*, Boisd., *D. cingulatus*, F., and *D. sidae*, Montr., on cotton; *D. sidae* and *Lygaeus familiaris*, F., on kapok [*Eriodendron anfractuosum*]; *Oxya gavisa*, Wlk., on rice; *Cylas formicarius*, F., on sweet potato; *Cyrtopeltis (Engytatus) tenuis*, Reut., on tobacco; and *Hippotion celerio*, L., on taro (*Colocasia esculentum*).

Rapports sommaires sur les travaux accomplis dans les laboratoires en 1936.—*Ann. Épiphyt. Phytogén.* N.S. **3** no. 2 pp. 275–290, many refs. Paris, 1937.

This report is a survey of the work carried out in 1936 at different entomological stations in France, much of the information having already been noticed. Near Bordeaux, the cold wet weather in the

spring and early summer reduced the population of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] and prevented its spread, while dry weather in August caused the foliage to wither and checked the development of the second generation. In further work on the production of resistant strains [cf. R.A.E., A 25 460], potatoes are being crossed with other tuberiferous species of *Solanum* that are resistant to the beetle [24 77, 190]. At low temperatures the development of larvae on two of the hybrids ceased, although it proceeded normally on potatoes. Larvae reared on the hybrids were able to pupate, but there was a heavy mortality rate. *Meigenia mutabilis*, Fall., oviposited on 3rd and 4th instar larvae, many of which died; the parasites were, however, unable to complete their development. A variety of this Tachinid was reared from larvae of *Crioceris asparagi*, L., and also oviposited on larvae of *L. decemlineata*. In rearing the parasites and predators imported from North America [25 365], it was found that the life-cycle of the Carabid, *Lebia grandis*, Hentz, was completed in 40–45 days at 23–25°C. [73·4–77°F.], but there was only one generation annually. *Podisus maculiventris*, Say, has been bred successfully, and 4,600 individuals have been liberated in various centres.

In districts near Rouen, the first flights of *Cydia (Laspeyresia) pomonella*, L., occurred in orchards on 18th and 19th May, but in storehouses maximum flight did not take place until mid-July and the moths continued to emerge until about 10th August. Infestation of walnuts in Grenoble was not serious. As many as 30 larvae per band were caught on walnut trees in bands of corrugated cardboard impregnated with beta-naphthol or alpha-naphthylamine, and with the latter substance all the larvae were dead by the end of October; the beta-naphthol was less effective. In Alsace, moths emerged on 6th May and were captured in traps on 14th; considerable damage was caused by the second generation. In the Massif-Central, infestation was slight throughout the season owing to heavy rainfall in the evenings, which checked the flight of the moths. Those of the first generation emerged from 17th May to mid-July, and oviposition was at its maximum on 19th June. The life-cycle was completed in 74 days, but only 1·8 of the larvae of the second generation reached maturity. A lead arsenate spray applied in mid-July gave good control. Many overwintering larvae were destroyed by fungi, and two Hymenopterous parasites, *Pimpla* sp. and *Ascogaster (Chelonus) quadridentatus*, Wesm., were reared.

Further work on *Anthonomus (pomorum*, L.) has shown that infestation on dessert apples was not serious in orchards where the trees are treated regularly in the first half of June. In cider apple orchards, early flowering varieties were the most heavily infested and may therefore be utilised as trap trees. Bands treated with beta-naphthol are of little use as a control as this chemical is repellent to the weevils. Winter spraying with oil of anthracene, sodium dinitrocresylate and potassium permanganate reduced the percentage of infested buds from 21 to 5, 11 and 9. The application of arsenicals to grafts of fruit trees in Normandy at the beginning of May was effective in protecting them against weevils of the genera *Phyllobius* and *Polydrusus*.

Lavender in the Basses-Alps was severely attacked by *Sophronia humerella*, Schiff.; in addition to control methods already noticed

[25 485], severely infested plants should be cut down and the old wood burnt immediately. *Arima marginata*, F., infesting pyrethrum plantations was controlled by dusting with rotenone or barium fluosilicate, which was also effective against *Otiorrhynchus sulcatus*, F., on *Ruscus racemosus*, but caused scorching of leaves already attacked by this weevil.

Etiella zinckenella, Treit., was very abundant on pods of beans in a garden in one locality in May. In a mixed crop of beans and maize in damp, sandy soil near Bordeaux, seedling beans were heavily infested at the end of May by larvae of *Phorbia (Chortophila) cilicrura*, Rond., which mined and perforated the cotyledons and also attacked the embryo, deforming the hypocotyl so that the cotyledons were unable to push their way up through the soil. Larvae were collected in mid-June, and the adults appeared 20 days later. In further experiments on the control of *Contarinia nasturtii*, Kieff., infesting cauliflower [25 462] at Versailles, tests were carried out on the repellent action of para-phenylene-diamine, ethyl hydrosulphide, ammonium valerianate, creosote and chloronaphthalene, all in ground-nut oil which was emulsified with ammonium oleate in water. All were more effective as contact insecticides than as repellents, but at concentrations that were lethal for the Cecidomyiid the foliage was scorched.

Frankliniella intonsa, Tryb., was collected near Bordeaux on dahlia, tobacco and tomato, all of which are attacked by spotted wilt, but, experimentally, this virus did not appear to be transmitted by the thrips.

Further supplies of *Rodolia (Novius) cardinalis*, Muls., are being bred for the control of *Icerya purchasi*, Mask. [19 275] in the Basque country. Supplies of *Aphelinus mali*, Hald., bred at the Bordeaux station, have now been distributed throughout France.

A final section of the report deals with experimental work on the preparation and application of many insecticidal sprays and dusts.

FYTAUD (J.). **Le Doryphore et l'Europe.**—*Rev. Zool. agric.* **36** no. 1 pp. 1-13, 15 refs. Bordeaux, January 1937. [Recd. June 1937.]

A brief review is given of legislation brought into force in European countries (including the British Isles, Germany, Belgium, Holland and Luxembourg) to prevent the importation of *Leptinotarsa decemlineata*, Say, from France and of the resolutions adopted by two international conferences on this pest held at Paris and Brussels in 1932 and 1936, respectively.

FYTAUD (J.). **Recherches sur le Doryphore III.—Causes de réduction naturelles (milieu-maladies-ennemis).**—*Ann. Épiphyt. Phytoprogén.* N.S. **3** no. 1 pp. 35-97, 2 pls., 4 figs., many refs. Paris, 1937.

This paper is a third of a series [*R.A.E.*, A **20** 4; **21** 6] and forms a comprehensive review of work by the author and others on factors limiting the population increase in *Leptinotarsa decemlineata*, Say, on potato in France [*cf.* 25 498]. Fungi and bacteria attacking the beetle are discussed at some length, and a detailed account of Arthropod parasites and predators [20 561] and of the rôle played by vertebrates in controlling infestation [24 757] is included.

KOZLOVSKY (S.). *Sur le décalage des générations du Leptinotarsa decemlineata Say en milieu artificiel.*—*Ann. Épiphyt. Phytogén.* N.S. 3 no. 1 pp. 99–111, 3 figs., 2 refs. Paris, 1937.

Experiments on the continuous breeding of *Leptinotarsa decemlineata*, Say, on potato were undertaken in France in 1932 to ensure that supplies of larvae should be available for imported parasites and predators throughout the year. Adults emerging towards the end of July were kept isolated from each other until the end of September. They were then placed in breeding cages, described in detail, in which 30 candle power electric lamps, operated continuously, kept the temperature between 24 and 14°C. [75·2 and 57·2°F.]. From these adults, eggs were obtained and the resulting larvae gave rise to adults emerging in November and December. Under similar experimental conditions, 5 successive generations were bred, the diapause apparently being omitted [cf. R.A.E., A 24 13].

The time elapsing between pairing and oviposition varied from 2 to 7 days. At the beginning of the oviposition period the eggs are laid in orderly batches of 20–40 each, but towards the end they are distributed irregularly. The maximum laid by any individual was 2,232. The incubation period, the 1st, 2nd, 3rd and 4th larval instars and the pupal stage last about 6–10, 3–5, 2–4, 2–5, 9–18 and 5–19 days, respectively, but the life-cycle is generally completed in 36–47 days. Larvae reared on *Solanum nigrum* underwent an additional moult. Some were reared on slices of potato tubers and pupated successfully, but the mortality rate was high; adults appeared to be unaffected by this diet. Some adults were kept in captivity for 10 months.

BRUNETEAU (J.). *Recherches sur les ennemis naturels du doryphore en Amérique.*—*Ann. Épiphyt. Phytogén.* N.S. 3 no. 1 pp. 113–135, 14 figs., 10 refs. Paris, 1937.

Most of this information on the collection of the natural enemies of the Colorado potato beetle, *Leptinotarsa decemlineata*, Say, in North America for shipment to France has already been noticed [R.A.E., A 25 365]. Brief descriptive notes are given on the species concerned and on the methods and effects of parasitism.

BALACHOWSKY (A.). *Recherches sur l'utilisation du froid dans la lutte contre le ver des cerises (*Rhagoletis cerasi* L.).*—*Ann. Épiphyt. Phytogén.* N.S. 3 no. 1 pp. 137–140. Paris, 1937.

Ripe cherries infested with *Rhagoletis cerasi*, L., in France were submitted to different temperatures in an attempt to destroy this fly and render the fruit fit for export. At -9·5 and -4·5°C. [14·9 and 23·9°F.] the shortest exposures necessary for a mortality rate of 100 per cent. were 16 and 64 hours, and at -2·5°C. [27·5°F.] an exposure of 8 days gave a mortality rate of only 60 per cent. In a saturated atmosphere, a mortality rate of 100 per cent. was obtained with exposures of 12, 6 and 3 hours to temperatures of 44, 56 and 57°C. [111·2, 132·8 and 134·6°F.], respectively. At all temperatures at which the larvae were killed, the fruit was considerably damaged.

FRAPPA (C.). Note sur deux espèces de *Pamphila* nuisibles au riz à Madagascar.—*Riz et Rizic.* 11 fasc. 1 pp. 19–24, 8 refs. Paris, February 1937.

Descriptions are given of *Parnara (Pamphila) borbonica*, Boisd., and *P. (P.) poutieri*, Boisd., infesting rice in Madagascar. The larvae of *P. borbonica* are abundant on the high plateaux during the rainy season. In February 1933, they were found attacking rice seedlings in a nursery. They make a shelter of rice leaves and eat the parenchyma of the young leaves, generally avoiding the lower epidermis, which withers and becomes bleached. Feeding takes place only in the early morning, while the leaves are still covered with dew. During the day, the larvae remain concealed in their shelters or float in the rice-fields amongst the leaves they have eaten off. Under laboratory conditions, mature larvae pupate within a shelter of leaves, the pupal stage lasting 14–16 days. Where the soil can be drained, the larvae are exposed to attack by ants and are in any case unable to survive the dry conditions. In one locality in March, a Chalcidoid and an Ichneumonid that parasitised the larvae and pupae, respectively, were reared. *P. poutieri* occurs throughout the island, but is commoner in the coastal regions. Its bionomics are thought to resemble those of *P. borbonica*. Serious damage by either species is rare.

Annual Report on the Working of the Department of Agriculture during 1935–36.—66 pp. Malta, 1937.

In the section on Plant Pathology (pp. xxviii–xxx) compiled from the records of the late P. Borg, it is reported that *Icerya purchasi*, Mask., is being well controlled in Malta and Gozo by *Rodolia (Novius) cardinalis*, Muls. *Ceratitis capitata*, Wied., on stone-fruit and *Citrus* was successfully controlled with traps baited with Clensel [R.A.E., A 24 800] and water (1 : 20), used from June to December at the rate of one trap to 3 or 4 trees.

Experiments on the control of *Gryllotalpa gryllotalpa*, L., which is a serious pest of crops on irrigated lands, are reported in an appendix (p. xxxv), but were inconclusive owing to unequal infestation of the test plots.

SPOON (W.), VAN DER LAAN (P. A.), SMULDERS (C. M. L.) & DIAKONOFF (A.). **Het verschil in werkzaamheid van *Derris-* en *Lonchocarpus-*wortel en de onderscheiding van hun wortelpoeders.** [The Difference in Activity between *Derris* Root and *Lonchocarpus* Root and the Differentiation between their Powders.]—*Ber. HandMus. kolon. Inst. Amst.* no. 110, 26 pp., 2 figs., 1 graph, 5 diagr. Amsterdam, 1937. Repr. from *De Indische Mercuur* 60 nos. 18–19, pp. 259, 275, 5th and 12th May 1937. (With a Summary in English.)

DIAKONOFF (A.). **Het Onderscheiden van *Derris-* en *Lonchocarpus-*poeder.** [Differentiation of *Derris* and *Lonchocarpus* Powders.]—*Pharm. Weekbl.* 1937 no. 29, repr. 9 pp., 1 fig., 1 graph. Amsterdam, 1937.

Eight pairs of samples of dusts of *Lonchocarpus* and *Derris* roots, yielding approximately equal amounts of rotenone and ether extract, diluted with kieselguhr to strengths of $\frac{1}{2}$, $\frac{3}{4}$ and 1 per cent. rotenone, were dusted on young larvae of *Nygma phaeorrhoea*, Don. (*Euproctis*

chrysorrhoea, auct.), larvae of *Diprion (Lophyrus) pini*, L., and the ant, *Myrmica rubra*, L. In seven pairs, the *Derris* dusts proved about one and a half times as effective against the moth and sawfly larvae and twice as active against the ants as the *Lonchocarpus* dusts. *Derris* dusts with $\frac{1}{2}$ per cent. rotenone content were more effective than *Lonchocarpus* dusts with 1 per cent. The results are shown in a series of diagrams.

A method is described whereby the powders of the two roots may be distinguished by the shape and size of the characteristic starch grains.

Inlichtingen en onderzoeken van de Afdeeling Handelsmuseum in 1935. [Investigations of the Commercial Museum Division in 1935.]—*Meded. kolon. Inst. Amst.* no. 39 (Afd. HandMus. no. 16) 170 pp., illust. Amsterdam, 1936. [Recd. July 1937.]

A section of this report (pp. 78–102) contains the results of tests with *Derris* dusts on insects in Holland [R.A.E., A 24 518] notes on *Lonchocarpus* root, stating that while its percentages of rotenone and ether extract were good, it appeared to be less active biologically [see preceding abstract], and the results of examinations of samples of *Tephrosia candida*, *T. noctiflora*, *T. vestita*, *T. villosa* (all from Java) and *T. toxicaria* (from Surinam). They yielded percentages of ether extract of 1·9, 3·5, 1·7, 3·8 and 3·8, respectively, while a sample of *Derris elliptica* from the Netherlands Indies yielded 17. In dusting tests on *Myrmica rubra*, L., and larvae of *Phalera bucephala*, L., none of the five species of *Tephrosia*, even if undiluted, injured the insects, whereas the *Derris*, diluted 1 to 4 with kieselguhr to a concentration of 3·4 per cent. ether extract, always proved fatal. In spraying tests with batches of 100 black leaf Aphids, the numbers of individuals found dead about 20 hours afterwards were 1, 2, 5, 1 and 11, respectively, for the above five varieties of *Tephrosia*. With plain water 3 were dead, and with *Derris* 67.

FONSECA (J. P.). A lagarta do abacaxi. [A Lepidopterous Pest of Pineapple.]—*O Biológico* 3 no. 1 pp. 21–22. S. Paulo, January 1937. [Recd. July 1937.]

All stages are described of the Lycaenid, *Tmolus (Thecla) echion*, L., which is a common pest of pineapple in S. Paulo, Brazil. Data on its life-history as recorded in Trinidad [R.A.E., A 16 158] are given. The measure suggested here is the use of a spray containing 0·5 per mill 40 per cent. nicotine sulphate and 30 per mille Paris green. The application must be repeated if heavy rain falls after it.

MARSHALL (J.) & GROVES (K.). W.S.C. "Dynamite" Spray—how to mix and use it.—*Ext. Bull. St. Coll. Wash.* no. 232, 8 pp. Pullman, Wash., March 1937.

Further information is given on the preparation of W.S.C. Dynamite sprays for the control of codling moth [*Cydia pomonella*, L.] on apple in Washington State [cf. R.A.E., A 25 419]. To make 100 U.S. gals. spray, $\frac{1}{2}$ U.S. pint of a mixture consisting of water and triethanolamine, 6 : 1 or water and 28 per cent. ammonia, 12 : 8, should be stirred into 1 U.S. gal. water, and $\frac{1}{2}$ U.S. gal. of a mixture of raw summer petroleum oil and high grade oleic acid, 19 : 1, then added and stirred until a milky oil emulsion results. While the spray

tank is filling, 3 lb. pure, non-flocculated, non-stabilised lead arsenate is placed in it, and when it is nearly full, the oil emulsion is added. The lead arsenate flocculates in a few seconds. Modified W.S.C. Dynamite is prepared in a similar way, but a mixture of kerosene and herring oil, 3 : 1, replaces the summer petroleum oil.

The unmodified spray should be applied uniformly at the rate of about 75 U.S. gals. per tree bearing a crop of 30–35 packed boxes. It should not be used after 1st July [cf. loc. cit.], but the modified form may be applied during May, June and July.

Directions are given for obviating possible difficulties in the preparation of these sprays, e.g., hard water, excessive stability, and floating material.

SWAN (D. C.). Insects and other Invertebrates of economic Importance in South Australia during the Period July 1934, to June 1936.—
J. Dep. Agric. S. Aust. **40** no. 9 pp. 717–731, 13 figs., 15 refs.
 Adelaide, April 1937.

In this fourth biennial report [cf. *R.A.E.*, A **19** 398; **21** 65; **23** 398], the presence is recorded of swarms of *Austroicetes jungi*, Branc., in South Australia in summer 1935 and spring 1936, in some of the districts where *Chortoicetes terminifera*, Wlk. [**25** 348, etc.] had been present during the previous year. Wheat was attacked and to some extent barley. There is only one generation a year. The swarming individuals do not exhibit the migratory tendencies of *C. terminifera*. It is probable that *A. jungi* recurs in plague form in these districts more frequently than *C. terminifera*. In spring 1935, larvae of *Desiantha caudata*, Pasc., attacked 70 and 100 acres of young wheat plants in two districts in the south and south-west respectively, causing bare patches in the crop. Three or more larvae were found at the base of each affected plant. The wheat had been sown on former grassland ploughed up a few weeks previously. The larvae of *Dasygaster hollandiae*, Gn., destroyed thousands of acres of wheat and grass in Eyre's Peninsula in 1934, pupating beneath the soil surface. When bred out, the moths emerged in December. *Persectania ewingi*, Westw., which infested barley and wheat at the Waite Institute in November 1934, was controlled by a bait composed of 1 lb. Paris green, 24 lb. bran, 3 gals. water and 8 oz. salt applied at the rate of 15 lb. per acre.

Pests of pasture and forage crops included *Gryllulus* (*Gryllus*) *servillei*, Sauss, which destroyed pasture in the south-east during the late summer of 1934–35, in districts where the soil was heavy, sheltering in the cracks that form in it when dry. Arsenical bran baits or a bait prepared according to the formula quoted for the control of *P. ewingi* reduces their numbers. In spring 1935, the Hepialid, *Oncopera fasciculata*, Wlk., gave rise to bare patches of pasture, one of which was several acres in extent. Larvae and pupae were found in burrows 6 ins. deep in the soil, lined with coarse brown silk. The adults emerge in the late afternoon and evening. The larvae apparently begin feeding in early autumn and become mature in late winter. The moth, which is only found in the State in the volcanic areas of the extreme south-east, is best controlled by thorough cultivation of affected grasslands. *Halotydeus destructor*, Tucker [**23** 149] occurred in winter 1936 in the south-east and at various localities within the 15 ins. isohyet. In one case, 25 acres of peas were much retarded,

the young plants being attacked as soon as they appeared above the ground. Sprays of nicotine sulphate (1 : 800) with soap, or lime-sulphur (1 : 100) with a suitable wetting agent may be used, and neighbouring weeds removed.

Monolepta divisa, Blkb., infested immature grape clusters, and the weevil, *Cubicorrhynchus maculatus*, Macleay, was for the first time found boring into the roots of young almond trees.

At the end of 1935, galls formed by *Eriosoma lanuginosum*, Htg., on elm (probably *Ulmus hollandica*) were obtained for the first time in South Australia [cf. 17 475]. *Cardiaspis vittaformis*, Frogg., first described from iron-bark gums (*Eucalyptus ? paniculata*) in New South Wales, damaged red gum (*Eucalyptus rostrata*) in the south-east in May 1935 and April 1936. The leaves withered and died in patches around the scales, and often fell off, but new ones grew the following summer. The Psyllids have not been observed to live on other species of *Eucalyptus* in South Australia. *Diadoxus erythrurus*, White, damaged hedges of *Cypressus macrocarpa* in widely separated districts. *Otiorrhynchus cribricollis*, Gyll. [21 626, etc.] attacks apple, plum, almond, olive and rose near Adelaide, and lucerne and vines in some localities. In November 1936, the larvae of this weevil damaged the roots of every tree in a plantation of several hundred young ash trees, which were stunted in consequence. *Hyalarcta nigrescens*, Doubleday, damaged the foliage of *Eucalyptus gomphoccephala*.

Miscellaneous observations include *Anuraphis tulipae*, Boy., in March 1935, on tulip bulbs imported from Victoria, *Spermophagus (Euspermophagus) sericeus*, Geoff., in December 1934, infesting the seeds of *Convolvulus arvensis* among beet seed from New Zealand, *Lonchaea aurea*, Macq., tunnelling stems of kale, a Tyroglyphid mite, apparently *Tyroglyphus lintneri*, Osb., and the Collembolan, *Hypogastrura armata*, Nic., damaging mushrooms, and larvae of *Roeselia lugens*, Wlk., during the spring of 1936 on *Eucalyptus cladocalyx* and *E. rostrata*, the leaves of which they eat irregularly from the margins to the midrib, leaving only the vascular skeleton.

YAGI (N.). Means to kill or remove parasitic Dipteran Larvae by their negative Oscillotropism.—*Proc. imp. Acad. Japan* 13 no. 5 pp. 165–168, 8 figs. Tokyo, May 1937.

The author has observed strong negative oscillotropism in the larvae of many Diptera, including *Drosophila suzukii*, Mats., a very serious pest of cherries and grapes in Japan, an Agromyzid that mines in rice, a Trypetid that infests cherries and the Tachinid, *Sturmia (Crossocosmia) sericariae*, Rond., which parasitises larvae and pupae of silkworms [*Bombyx mori*, L.]. In experiments in 1935–36, all these were observed to be sensitive to simple mechanical, sonic or supersonic vibrations, and it is suggested that methods of this type might be used in control. Cherries infested with *D. suzukii* were put in a beaker or celluloid case filled with water and subjected to supersonic vibrations. Other conditions being equal, the time required for getting rid of the larvae depended upon the velocity of their negative oscillotropic movements, the velocity varying according to the size of the larvae and the strength of oscillative stimulation. When the quartz used began to vibrate under the beaker, the larvae in the cherries

began to work upwards within the fruit and eventually crawled out into the water. In this way, in 3–5 minutes practically all the insects could be driven out of the fruit. Using the same method, it took about 10 minutes to drive out the larvae of the Trypetid. The full-grown Agromyzid larvae in leaves of rice invariably retreated into the distal part of the leaf and died if the oscillations lasted more than 5 minutes. In the case of *S. sericariae*, the larvae invariably detached themselves from the pupal wall of the host, moved away from the centre of stimulation and eventually died of asphyxiation. If treatment is applied in the early stages of parasitism, apparently normal moths emerge, pair and lay eggs [cf. R.A.E., A 23 677]. The only sign that a moth contains a dead parasite larva is a dark patch on the skin at the infested part.

A similar result was obtained by the stimulation of audible sound waves of adequate pressure, the apparatus used being described.

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